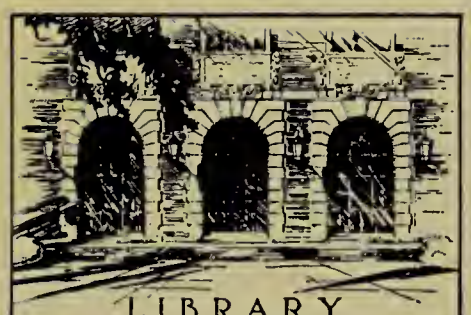
Withdrawn from
Western Reserve University Library



LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS
666.05
CE
v.34
REMOTE STORAGE

Cement and Engineering News

Vol. 34 **Chicago, January, 1922** **No. 1**

GREETINGS

The Season's Greetings to you and yours, with the sincere wish that during the coming year you will be blessed with happiness and prosperity.

Concrete Institute Convention

The American Concrete Institute will hold their convention in Cleveland, O., on February 13, 14, 15 and 16, 1922.

The program, as outlined by the Board of Direction, after considering the committee reports which are expected to be ready for discussion, will be spread over nine convention sessions—two sessions a day for three days and three sessions on a fourth day. These will be divided as follows: two sessions for contractor problems—the practical problems on the job; two sessions for concrete products manufacturers; one session on Roads; one session on Houses; one session on Research; two sessions on Engineering Design and Inspection.

The Institute Committees are probably better organized this year to cover thoroughly the work of the concrete field than they have ever been before. While theoretically the A. C. I. has always stood for all development worthy of notice in concrete work, it has perhaps in its later years given more attention to technical and theoretical matters in some lines than to the practical problems of the field, which are as clearly important.

A previous announcement will be recalled having to do with the work undertaken by a special Committee on Organization appointed at the time of the last Convention. It was asked to review the whole field of technical activities of the Institute; to make certain recommendations to the Board of Direction as to the reorganization of old committees and the appointment of new ones, to outline a program for committee work, where committee programs did not already exist and to accomplish the whole thing with special reference to three distinct groups of interest represented in Institute membership, namely: Engineering Design and Inspection, Construction, Products Manufacture.

The Committee on Organization had the following membership:

S. C. Hollister, Chairman, and A. T. Goldbeck, Engineering Design and Inspection; E. J. Moore and N. M. Loney, Construction; R. F. Havlik and Harvey Whipple, 314 New Telegraph Bldg., Detroit, Secretary, Concrete Products Manufacture. It held two all-day meetings March 17 and May 4 ,and accomplished considerable by correspondence also. It presented its report at a meeting of the Board of Direction May 6, and with only minor modification, the report was adopted as a working program for Institute activities.

In setting down an outline of the Institute's general policy, the report of the Committee on Organization reminds the institute membership of the breadth of field work of the Institute set forth under the heading "Objects" in the original charter:

"To disseminate information and experience upon and to promote the best methods to be employed in the uses of cement by means of Convention, the reading and discussion of papers upon materials of a cement nature and their uses . . . and to circulate among its members by means of publications, the information thus obtained."

In its relations to the work of other organizations, it is maintained that the Institute should adhere strictly to the right of independent action upon any matter within its field, but to insure at all times a knowledge of progress in other organizations, there shall be officially designated visiting memberships from our committees in similar committees of other organizations whenever this is agreeable to the other organizations affected, and this arrangement be made reciprocal by welcoming visiting memberships from other organizations.

In considering the membership of the Institute as divided among three groups of interest, it seemed desirable to consider this grouping merely as classifying the viewpoint and scope of interest of the members of the Institute and not to use it as a basis for dividing Institute work, as so many of the problems of the field depend for their solution upon the co-operation of two or more of the groups. On this same basis, it was recommended that the convention of the Institute should not be held in overlapping sections.

How to Use Cal

A new circular has been issued by the Cal Chemical Co., Hagerstown, Md. This is a general descriptive circular telling how to use Cal and what it does. Cal is defined as a chemical powder which produces set and strength of concrete in approximately half the time ordinarily required. Various illustrations are included, showing where and how Cal can be used to advantage.

96989

Perfect Package Month

Postmaster Arthur C. Lueder, Chicago, announces that the Post Office Department and the express and railway companies have joined in a nation wide effort to stimulate greater interest in the good packing of parcel post, express, and freight packages. This month has been selected as the "Perfect Package Month" during which an active campaign will be conducted to induce all mailers and shippers to give their attention to the manner in which their goods are packed, kind of containers used, and the writing or marking addresses plainly and completely. This is of great public interest, because in the end the public must pay the bills for lost or damaged shipments. Therefore, the public should be deeply interested in the campaign which will tend to reduce losses and improve the service.

Christmas will soon be here, and it is especially desirable that care should be exercised in the preparation of packages at this time, because now the occasional mailer or shipper will be sending packages. Articles easily broken should be carefully wrapped in corrugated or shock absorbing paper. The department stores use this kind of paper in delivering breakable articles, and it would be an excellent practice for housewives to save this paper for use when they are sending out their own packages.

Noted Engineer and Educator Is Dead

Henry Turner Eddy, professor and dean emeritus of the University of Minnesota, and recognized as one of America's leading men of science, died last month in Minneapolis, at his home, 1401 East River road. Death was due to heart disease, complicated by an acute attack of pneumonia. He had been ill but a few days.

During his years as an instructor, Dr. Eddy wrote many treatises on mathematics, among them "Analytical Geometry" in 1874, "Researches in Graphical Statics" in 1878, "Thermodynamics" in 1879, "Neue Constructionen aus der Graphischen Statik" in 1880, "Maximum Stresses Under Concrete Loads" in 1890 and "Theory of Reinforced Concrete Floor Slabs" in 1913. He was co-author with C. A. P. Turner of "Concrete Steel Construction," published in 1914, and contributed many papers to mathematical and technical journals.

The article in the December, 1921, issue, CEMENT AND ENGINEERING NEWS, entitled "The Geometry of Progress in Structural Engineering or Euclidian Principles Applied to Stress Analysis and Volumetric Measurement of Mechanical Intelligence" by C. A. P. Turner, C.E., will be copyrighted. Ultimately it is Mr. Turner's intention to publish an advanced work on "Concrete" in which these principles will be applied, dedicating the work to his old friend and co-worker, Dr. Eddy.

Virgin Growth and Second Growth Timber

Specifications often call for virgin growth or second growth timber, yet the terms are without fixed significance, and the material when delivered cannot be identified positively as belonging to one class or the other.

Virgin growth is generally thought of as slow growing timber, while second growth, due to more favorable conditions, is relatively rapid. A faster rate of growth is evidenced by wider annual rings, which are popularly supposed to indicate stronger and tougher wood in the hardwoods, such as ash, hickory, elm and oak; and weaker and brashy wood in the conifers, such as pine and fir. Hence, for uses in which strength and toughness are essential, second growth is sought among the hardwoods; in conifers virgin growth is desired.

As a second growth forest attains maturity, the rate of growth slows up, and the annual rings may be no wider than in virgin growth timber of the same size. On the other hand, when a slow-growing suppressed forest tree is freed by removing the neighboring trees, it may grow rapidly for a long period. Therefore, it is possible to have some wood with the characteristics of virgin growth and some with those of second growth in the same tree. Furthermore, individual trees in a virgin growth forest may have the characteristics of second growth throughout and vice versa. The Forest Products Laboratory, Madison, Wis., considers it advisable to disregard rate of growth and rely upon density as a guide to quality.

POTENTIAL WATER-POWER

Estimates of potential water-power vary according to the bases upon which they are made. The maximum flow is taken by the Geological Survey to be that amount the continuance of which for six months of the year may be assured. On this basis the estimated potential water-power of the United States is 59,360 horse-power. Another basis used by the Geological Survey is the minimum flow for two consecutive seven-day periods in each year over the period of measurement, and the additional power that may be recovered through the development of available storage capacity in the upper basins of the streams and the use of the stored water to increase the flow in normally low-water periods. Estimates of potential power based upon storage capacity are subject to a wide margin or error, owing to limited data available. Indeed, one of the most necessary tasks to be undertaken by the newly created Federal Power Commission is a more comprehensive survey of the whole range of possible water-power development than has hitherto been attempted.

The potential water-power of the country, estimated on the basis of the maximum flow as defined above, is given in the table following. The table shows also the undeveloped power, the total potential power less that developed as shown in the previous table. The figures represent the horse-power of the streams at 90 pe r cent. efficiency. In making comparisons of the potential with the developed power, it should be noted that estimates of the former are given in terms of continuous, or twenty-four-hour, horse-power, while the developed power is given in terms of the installed capacity. The installed capacity is developed in many cases only during a portion of each day. Hence it happens in some states that the developed power, or installed capacity of works constructed is in excess of the estimated total potential power.

Water Powers of Continental United States

	Potential Horsepower	Percent Developed	Undeveloped Horsepower
New England States	1,951,000	77.2	444,500
Atlantic States	9,348,000	31.6	6,395,150
Central States	7,360,000	36.7	4,660,800
Mountain States	14,851,000	7.5	13,737,010
Pacific States	25,850,000	6.6	24,299,000
United States	59,360,000	16.6	49,536,460

TE6.6.C3
CE
v.34

Generally speaking, more than three-fourths of the potential water-power of New England has already bee ndeveloped; in the remainedr of the country east of the Rockies roughly one-third is developed, and in the Far West about one-sixteenth is in use. While, then, most of the water-power awaiting development is in the Far West, where 68.6 per cent of the potential power is found, the central and eastern States also have immense power resources not yet brought into use.

And Alaska possesses vast water-power resources which have not as yet been surveyed. It is estimated, however, that there is water-power available in such quantity in the Territory as eventually to assure great industrial development in Alaska. The possibilities of these resources are now being investigated by the United States Geological Survey.

Safety Devices Would Eliminate Three-Fourths of Fatal Elevator Accidents

NOV 26 1950 HARDY

Nearly three-quarters of the fatal elevator accidents that occur could be prevented if elevators and shaftway doors were equipped with well-designed interlocking devices, a survey and study conducted by the Bureau of Standards of the Department of Commerce has shown.

A large number of elevator fatalities occur at the shaft door, either through an open door which allows a person to fall down the shaft or it allows a person to step from a moving car and be crushed between the car and the door frame. An inter-lock prevents the shfat door from being open except when the car is at rest in front of the door.

Elevator safety is declared to be as important as street car safety as the Bureau of Standards investigators have found that about as many ride on elevators as on all the city traction lines. Postmen, messengers, and others rely on them and their safety devices to a large extent.

In providing vertical transportation, elevators travel long distances each day and make many stops. For instance, an elevator in the Woolworth Building travels about 40 miles a day and makes 4000 stops in that time.

The Metric System

The metric system and measures constitute a scientific system; our system is a disorganization. It is now generally admitted by the majority of intelligent persons in this country that the metric system is a much simpler and better system than that based on the customary Anglo-American standards. The metric system is an international system in the sense that it is employed in all accurate scientific work, in America as elsewhere, and also that it is in use in everyday life in all civilized countries excepting America, Great Britain and its colonies.

The first step should be to bring commercial organizations of this country to a realization of the fact that our present system of standards is injurious to our foreign trade. The importance of the use of the metric system not only in foreign commerce but also at home is becoming recognized. It is necessary to us because a large part of the world with which we carry on commerce has adopted it. Commercial organizations must be brought to realize that the present system is very wasteful of our most precious commodity-time. The saving of time brought on by the metric system would repay the annoyance brought on by the change.

We have observed the fact that a change to the metric system is needed for the sake of foreign commerce. We are encouraged by the fact that several large chemical concerns are now using this system as a business basis. In addition we now see that we need it also in general commercial and manufacturing transactions. If we are to have the efficiency so insistently demanded by the age in which we live, then we must have the metric system in use for the ordinary affairs of daily life of the mass of the people, we must have it in education and we must have it in commercial and manufacturing industries. If efficiency is to be the slogan of this country, then the metric system must come, no matter what obstacles stand in its way.

Bradley S. Carr Heads Pump Department

Bradley S. Carr has been appointed manager of the pump department of the American Manganese Steel Co., Mr. Carr is well equipped to advise in matters pertaining to centrifugal pumps through his training and years of practical experience.

With exceptional mathematical knowledge and high scientific attainment he combines the fine characteristics of simplicity, courtly manners and gentleness, which causes him to be honored by his company and respected by all who come in contact with him. Mr. Carr has made a name for himself in the sand and gravel industry and stands at the very head of the dredging pump profession.

Cement Specifications for Foreign Countries

The specifications that the various countries of the world use in buying portland cement have been summarized in a chart that has just been issued by the Bureau of Standards of the Department of Commerce.

Cement is an international building material and thirty-two countries of the world have specifications for portland cement, twenty of which differ in important details from each other. Twenty-five others use the specifications of other countries in assuring the quality of the cement used in construction within the country, and many others accept the cement if it passes the tests of the country in which it is made.

Though the specifications differ in details and values, they include the same kind of tests in most cases. These are tests for chemical composition, specific gravity, fineness of grinding, setting time, soundness, and tensile and compressive strength.

In this country, there is one universal specification for portland cement, which has been adopted by the commercial interests, testing engineers as well as the Government.

U. OF ILL. LIB.

Highway Experts Pass on Final Design of "Ideal Section"

Leading highway experts of the United States and nationally known authorities on such related subjects as highway beautification and automotive design, met recently to consider the finally developed plans for the construction and embellishment of an "Ideal Section" of the Lincoln Highway, to be constructed in Lake County, Indiana, near Chicago. These men, picked from the national leaders in their various fields of expert knowledge, form the Technical Committee of the Lincoln Highway Association which was appointed over a year ago by the Association to consider the important problem of proper design for America's main highways and to draft, in consultation, a set of specifications representing their vision of the ultimate development of the modern, main highway.

The Committee unanimously approved the detailed plans for the Section, prepared by Lockwood, Greene & Company, Engineers, and W. G. Thompson, Consulting Highway Engineer, for the Lincoln Highway Association. These plans call for a section approximately one and three quarters miles in length, which it is believed will be adequate to impress the lessons the Association and the Committee have endeavored to embody in the design. The plans comprise forty feet of reinforced concrete pavement, ten inches thick, laid in the center of a one hundred foot right of way, the outer twenty-five feet of which, on each side, will be landscaped and beautified under the direction of Jens Jensen, the well-known Chicago land-scape architect. There will be no open ditches, drainage being provided by submerged drain tile. A sidewalk is included for the safety of pedestrians and the paved way will be illuminated by the most modern and economical system, devised by the illuminating engineers of the General Electric Company. One bridge is included in the plan and it also will make provisions for foot passengers as well as providing a full forty feet of width for vehicular transportation.

It should be borne in mind that the roadway which the Lincoln Highway Association plans to construct next spring at the location mentioned was designed by its Committee of experts to represent the highest possible development needed on the heaviest travelled sections of the most important highways in the United States. In designing the Ideal Section, the Association's Technical Committee had in mind an ultimate traffic volume of 20,000 vehicles per twenty-four hour day and assumed that 5,000 of these vehicles would be motor trucks, carrying freight. While this is a traffic slightly beyond that now encountered on any road in the United States, it is not beyond that which is bound to develop on many of our most important arteries of transportation during the life of roadways laid in the immediate future. The nature of the design bears no relationship to the traffic volume now existing on the Lincoln Highway at the location tentatively selected. This location is being considered because it is central as regards the United States as a whole and convenient to Chicago, while yet being in the open country.

National interest has already been aroused in the Lincoln Highway Association's practical plan for crystallizing the best thought in America as related to modern highway design. Once built, the Ideal Section will be subjected to constant study by the United States Office of Public Roads and by road-building agencies in every section of the country. In fact, it will be internationally famous as the most perfect stretch of modern roadway constructed anywhere, to date. International interest will center on this section of improvement. Already, the Association has received from many foreign countries, requests for information as to the nature of the design and A. F. Bement, Vice-President and Secretary of the Lincoln Highway Association has been asked to prepare a paper relating to the Ideal Section design and its significance to motor rtansport, before the Fourth International Road Congress to be held next spring in Seville, Spain.

The cost of this educational section of modern road will be borne jointly by the United States Government, the State of Indiana, Lake County and the Lincoln Highway Association. The Association, which initiated the project, which is expected to have such a far-reaching effect upon the ultimate design of America's main highways is bearing the largest portion of the expense through a fund appropriated to it for the purpose by the United States Rubber Company, the officials of which are greatly interested in the Association's work, J. N. Gunn, Vice-President of the United States Rubber Company, President of the United States Tire Company and of the Lincoln Highway Association, attended the meeting here yesterday and expressed himself as greatly pleased over the final decision of the Committee.

The Thermal Conductivity and Diffusivity of Concrete

As a result of the rapidly increasing use of concrete in various forms of construction it has become important to have some definite information as to the thermal conductivity and diffusivity of different concrete mixtures.

The bulletin deals with certain experimental work carried on at the Engineering Experiment Station with the object of determining these properties for a number of speciments representing certain standard mixtures. During the last ten years the composition and methods of preparation of concrete mixtures have been studied and standardized, and present investigators have had the advantage of dealing with concrete mixtures which can be described much more definitely than was possible a few years ago. The results of only a few determinations of the thermal conductivity of concrete have been published previously, and to a large extent these lack definiteness in regard to the composition and method of preparation of the material.

Copies of this Bulletin No. 122 may be had without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

The Dallett Concrete Busher

Thos. H. Dallett Co., Philadelphia, Pa., has issued a new Bulletin (No. 1043) describing and illustrating a pneumatic tool made in two sizes, X, adapted for the bushing of fresh or green concrete, and X-W, adapted for the bushing of hard or seasoned concrete.

San Antonio Cement Company

Has One of the Largest Gas Power Plants in U. S. Operating On Lignite

Prominent among leading San Antonio, Texas, industries is the San Antonio Portland Cement Company, whose large plant is located a short distance north of the city at Cementville.

The plant of the company was built in 1908 and the buildings cover a total of more than seven acres. More than 200 men are constantly given employment and are housed in 52 buildings erected by the company as a part of its general activities.

One is able to grasp the wide extent of the company's operation when it is known that 400 barrels of oil are used daily. Two carloads of coal are consumed daily and the plant turns out 1,500 barrels of cement each day.

Officers of the company are C. Baumberger, president and general manager; F. W. Cook, vice-president and Albert Kronkosky, secretary.

The company has one of the largest gas power plants in the United States operating on lignite, and the San Antonio Portland Cement Company claims the distinction of using the largest vertical producer-gas engine in this country.

The engine room is equipped with four large gas engines, the original unit being 520-horsepower Allis-Chalmers horizontal engine, and the others are two four-cylinder vertical Rathbun engines of 500-horsepower each and an eight-cylinder Rathbun-Jones engine of 1,000-horsepower, made by the Rathbun-Jones Engineering Co., Toledo, Ohio. All of these engines have a bore of 21½ inches and a stroke of 24 inches and run a speed of 200 revolutions per minute. The 500-horsepower units are directly connected to 450 generators and the 1,000-horsepower twin unit is directly connected with a fly wheel type 850 K. V. A. generator.

Gas is furnished by a battery of eight 200-horsepower Smith Lignite Producers. This installation is especially interesting because of the continuous service required. The 1,000-horsepower engine was put into service August 1, 1914, after a preliminary run of only four hours. It was operated without a shutdown of any kind for a continuous period of 72 days or 1,728 hours. It was operated 122 days, or 2,898 hours, without making any adjustments.

One Engine Runs 10 Months

One of the older engines has a record run of ten months without having an igniter out, but usually the igniters are cleaned and adjusted every 60 or 90 days, as the opportunity occurs. The exhaust valves are inspected and reground every six months; the connecting rods are taken up four times per year and the main bearings twice a year.

This power plant is very compact, as all of the piping and the generator are within the floor space of 44 feet by 14 feet. This compact installation is secured by mounting the fly wheel generator between the two four-cylinder units.

Lubrication is supplied by an overhead oil tank from which oil flows by gravity in a small stream to each of the main bearings and from these the oil overflows into the base and supplies lubrication to the pistons and the connecting rod bearings by the splash system. Overflow pipes in the base keep the oil at a constant level, and through these the excess oil runs by gravity to fillers located in the basement of the engine room.

San Antonio Portland Cement Plant. 400 Barrels of Oil Are Used Daily for Fuel.

From these filters, the filtered oil is returned to the oil tank by a motor-driven oil pump. In addition to this lubrication, the pistons are equipped with forced feed which is used in case of excessive loads or for emergency. The oil consumption of the large engine is at the rate of three gallons per 24 hours.

The cost records for 1914 show that the expense of operating the entire plant, including fuel, labor, and repairs was ¾ cent per k. w. hour.

The plant is an example of what can be accomplished with the lower grade fuels. Lignite was for a long time considered an impossible producer fuel. The difficulties have finally been overcome by various engineers and the Smith lignite producer is a good example of these modern devices.

The plant operates 24 hours and has a day and a night shift. The entire plant is electrically driven and every piece of machinery has its own individual Westinghouse motors.

Moisture Is Removed

Among the different departments is the crusher where limestone and clay are mixed and crushed ready for drying and storage, and the dryer proper where all moisture is taken out for grinding, as mills will not handle rock containing over one per cent moisture. The ball tube mill, seven feet in diameter and nine feet long is charged with five-inch forged steel balls for the preliminary grinding of limestone and clay which reduces material to pass a 20-mesh cloth. This mill is driven by a 125-horsepower Westinghouse motor.

Two raw grinding tube mills each measure six feet in diameter and are 22 feet in length. These mills are charged and loaded to center line with flint pebbles which are imported direct from Europe. Material in these mills is ground to a fineness of 94 to 95 per cent on 100-mesh cloth. This is the final grinding of raw material, which pass from these mills to the burning kilns.

The burnings kilns are each 8 feet in diameter by 125 feet long and lined with Davis Fire Brick (Oak Hill, Ohio) throughout. Each kiln with lining weighs 300,000 lbs. and makes one revolution every minute and a half. The kilns are driven by variable speed motors, which gives the burner in charge of the kilns control to regulate the speed of same. The kiln sets on an incline and has a fall of about one-half inch to the foot and the raw material is fed in at the upper end by a screw conveyor and gradually rolls down as the kiln revolves; it takes about two and one-half hours for the material to pass through the kiln. The burning zone at the discharge end of the kiln carries a temperature of from 2,850 degrees Fahrenheit to 3,000 degrees Fahrenheit, and when the material discharges it is at the "fusing" point, as this is the heat that is required to bring about a chemical combination between the lime and clay matter. The material that is discharged is known as Portland Cement "clinker" and when ground to a fine powder and mixed with the proper retarder is the finished commercial Portland Cement.

There are several other departments, including the Peck carrier, manufactured by Link-Belt Company, clinker grinding tube mills and storage house for raw materials. The stock house has a storage capacity of 50,000 barrels.

The Reward of the Stayer

Did you ever realize that all the big life insurance companies are monuments to the lack of staying quality in men?

Their greatest source of revenue is from lapses.

That's why they can afford to pay such big dividends to the men who stay through to the end.

Successful advertisers—successful business men—are always stayers.

To make a success of advertising, one must stick to it like a barnacle to a boat's bottom.

Advertising doesn't jerk—it pulls—a steady pull.

Every ad goes to confirm the one before it—to strengthen the one that is to follow and there's no waste of effort or money.

The stayer wins every time.

Ten Commandments of Belt Conservation

Under the above heading, the Goodyear Tire & Rubber Co. makes the following valuable observations applying to rubber belting:

1. Don't use any certain number of plies as a standard. There is a proper number of plies for every pulley diameter. Choose the belt to handle each particular condition.

2. Don't cut belts without a steel square. Belts laced out of line will pull out of line; costly shutdowns and torn belts are the result.

3. Don't use one kind of lace for all kinds of work. There is a correct lace for each drive. No chain is stronger than its weakest link. The lace is the weak link in a belt. Choose the right one for the job.

4. Don't use belt dressing. Friction-surface rubber belts do not require it, and lumps on pulleys and belts are a dead loss in power; if belts slip, find the cause—larger, wider pulleys may be needed.

5. Don't lace belts too tightly. Your belts and bearings both have to stand the strain—the pulling power in a belt is in one side. Loose belts may be made to pull the same loads.

6. Don't run the seam side of a belt against the pulley. If a belt slips the sealing strip is soon burned out, the belt opens and is soon damaged beyond repair. If idlers are necessary, see that they are free from oil.

7. Don't make hasty decisions on belt failures. Increasing the number of plies may result in ply separation if the pulleys are too small. Analyze the failure—then decide on the next belt.

8. Don't let oil and water fall on the belts. Keep them clean and dry—pulleys and belts should be smooth to give good service.

9. Don't let idle belts hang on moving shafts or against the edge of a pulley. If they are not taken down, suspend them clear of the shaft and pulley.

10. Don't keep a belt on the pulley with a 2x4. Relace the belt straight, or line up the pulleys or shaft, eliminate the trouble, and save the belt.

Not many words are consumed in the "ten commandments," but they speak a volume if actually applied. The human equation, in the use of belting as with other products, is the greatest factor of all, being the power that can "make or break." With belt users, as with us all in every-day matters, they too often hear, but they do not heed. Inefficient power transmission is naturally the result.

Suggestions for Care and Operation of Wire Rope

Avoid Kinking Rope, Running Rope Over Badly-Worn Sheaves, Use Socket Fastening if Possible, and Keep the Rope Well Lubricated at All Times

By JAMES F. HOWE
Wire Rope Engineer, American Steel & Wire Co.

Wire rope should be kept in a dry place, away from the fumes of chemicals or acids and should be well protected by suitable lubricant or covering until it is ready to go into use. Ropes are sometimes badly rusted before going into service and this is due to lack of proper protection on the part of the user.

Short lengths of rope are usually shipped in coil and care must be exercised in unwinding so as not to kink the rope. The coils should be rolled like a hoop on the ground or floor as the case may be. The end should never be pulled out of the eye of the coil as is done in the case of manila rope. If a rope is kinked badly during installation, it is almost certain to fail in service at that point.

Long lengths of rope are usually shipped on reels which should be jacked up on a shaft at a point convenient to the installation and allowed to unwind slowly until the entire length of rope has been installed.

When changing an old rope for a new one, examine the sheaves and be sure that they are not grooved from the old rope. If so, have them turned out, renewed or relined, as the case may be, so that the new rope will not receive undue wear from this cause.

Sockets Preferable for Fastening

In making end fastenings use wherever possible a wire rope socket with zinc attachment. Where clips are used, be sure that the U-section bears on the slack side of the rope. Otherwise a crimp is placed on the tension side. Use a sufficient number of clips to properly hold the rope. The larger the rope diameter, the greater the number of clips required. Be sure that the nuts are tightened up frequently when rope is put into service, because the stretch of the rope reduces the holding power and may cause an accident. Whereve1 possible have thre full turns of the rope around the engine drum when rope is at its furthest point.

Keep a wire rope installation well lubricated at all times, using a grease or heavy oil which is guaranteed to be free from acid or alkali. In the summer time application can sometimes be made without heat, particularly if a heavy oil is used, but in the winter lubrication is best done by passing the rope through a trough of hot lubricant or smearing it with hot lubricant by means of a dauber.

If for any reason a temporary shut down becomes necessary, do not let the rope hang in the shaft, but bring both skips or cages to the surface and have the rope wound on the engine drum where it will be protected from moisture.

Avoid overwinding of one layer of rope on top of the other by having drum of sufficient diameter and width to take rope in one layer.

Be sure that sheaves and drums are properly aligned so as to avoid flange wear. In general lead sheaves should line with the center of the drum, provided the drum is entirely filled; but if the drum is partially filled the lead sheaves should line with the center of the filled portion of the drum.

Leads from drums to sheaves or angle sheaves should be made as easy as possible. An angle not exceeding 1 degree and 30 inches either side of the central line of sheave and drum will insure good conditions for mine hoisting.

Reversed Bending Hard on Rope

Reversed bending, that is, the passing of a rope over one sheave in one direction and over a second sheave in the opposite direction, so that the two bends are diametrically opposite, results in very severe service and is liable to crack the wires in a rope. It is better to re-arrange sheaves and avoid this condition wherever possible. If this cannot be avoided, the distance between the two sheaves making the reverse should be as great as possible, which will, to a certain extent, minimize the bad features of the reversed bending, although it will not entirely overcome it.

Sudden stresses from starting and stopping of loads should always be avoided. Acceleration of load should be gradual and sufficient time allowed not to over-strain the rope. This is particularly desirable on mine hoists to avoid accidents. Most hoists are so designed that there is sufficient time allowed to make the hoist without over-straining the rope by too great acceleration, and some of the improved electric hoists are arranged so that this point is automatic. In the case of other hoists, such as steam, the skill with which the engineer hoists determines the life of the rope.

Working loads should be dependent upon conditions but never exceeding one-fifth the ultimate strength of a rope after taking into account all stresses to which the rope is subjected, including increased load for starting as well as the weight of the rope itself. The effect of varyng lengths of rope and loads is described in Bulletin 75, Bureau of Mines.

Where rope is exposed to heat as is the case in smelters, steel mills and similar places, hemp center may be replaced with a soft wire center, which, however, is not desirable in other places.

Where acid, water, chemical fumes or similar conditions beset wire rope, the lubrication is extremely vital and must be maintained in sufficient quantity to keep out the acid which has the effect of rendering the wires brittle, in addition to the corrosive action which goes with it.

Directions for Attaching Sockets to Wire Rope

1. The rope should be securely seized at the end before cutting off and an additional seizing placed at a distance equal to the length of the basket of the socket away from the end. In the case of large ropes, this seizing should be several inches long and securely wrapped on with a special seizing iron. This is very important in order that the lay of the rope should not become untwisted, otherwise the tension on the strands may not be equal when the socket is applied.

2. Take off the end seizing on the rope, leaving the seizing at a distance equal to the length of the socket basket. Then cut out the hemp center back to this seizing and broom out the wires perfectly straight, i. e., they should all be untwisted, not necessarily straightened.

3. The wires for the distance that they are to be inserted in the socket should be carefully cleaned in benzine, naphtha or gasoline, and then the wires should be dipped in a bath of commercial muriatic acid

for a period of about 30 seconds to 1 minute, or until the acid has thoroughly cleaned each wire.

4. Dip the wires in boiling hot water to which has been added a small amount of soda to neutralize the acid, and insert the wires into the basket of the socket. Be sure that the socket lines with the axis of the rope.

5. Seal the base of the socket basket with putty, clay or similar substance, and pour molten zinc into the basket of the socket until it is full. The zinc must not be too hot or it will anneal the ends of the wires, particularly on smaller ropes. About 800 to 875 degrees should be sufficiently hot. When congealed, the socket can be plunged into cold water to cool off. If socketing is properly done, the wire rope when tested will break one or more strands between the sockets.

As a final word on the proper use of wire rope, reference should be made to the matter of rope fastenings. The finest rope made may render very inefficient service unless the proper fastenings are used to hold the ends. That fastening which comes the nearest to giving the full strength of the rope should always be applied wherever possible.

Based upon tests of the various rope fittings, the following comparative table shows the approximate efficiencies obtained by the use of different types of fittings:

	Per Cent
Wire rope sockets, open or closed	100
Ordinary thimble spliced in with tucked splices	90
Crosby type wire rope clip	85
3-bolt clamps	75

It is obvious, of course, that if the fastenings used are inefficient, the increased strength of the rope is of little value, because the rope is only as strong as it is at the fastening.

Hardinge Company Revises Section 1 of Its No. 7 Catalog

Owing to the large demand for literature, the Hardinge Company, 120 Broadway, New York, N. Y., has found it necessary to revise Section 1 of its No. 7 Catalog, which is now available. This section deals with the principle of operation of the conical mill, and gives a general description of its uses in the industrial, mining, and special fields. Those wishing copies should state in what class of grinding they are interested, in order that they may receive information dealing with their particular class of requirements.

Robert B. Moir Manager New York Branch

The W. A. Jones Foundry & Machine Co. announce the appointment of Mr. Robert B. Moid as manager of their New York branch. He will assume his new duties immediately, making headquarters at the present sales office and transmission warehouse of this company, 20 Murray Street.

Mr. Moid has been actively connected with the Home Office and factory for a number of years and is exceptionally well qualified to assist in power transmission and general engineering problems. This change will enable the Jones Company to co-operate with their many friends in the New York district even better than in the past.

Cement Association Bases Membership on Quality of Product

At the final session of the Annual Meeting of the Portland Cement Association, which was held last week at the Biltmore Hotel, New York, the Association's Constitution and By-Laws were amended so as to make membership in the Association "Contingent upon member's product meeting the Standard Specifications for Portland Cement adopted by the United States Government and the American Society for Testing Materials."

Engineers, architects and contractors are familiar with the high standard of specifications governing cement manufacture and will herald this action as the greatest advance step ever taken by the industry.

Along with other scientific-educational-research activities, the Portland Cement Association is distinguished for its co-operative work with technical societies. This has been in the nature of contributing to the improvement of building materials, methods and standards in general, among these being building codes, but the Association has particularly been active in keeping standard requirements for portland cement on a high plane and in insuring its proper use by the consuming public.

The Association is not concerned with the commercial relations of its members to their patrons and while not undertaking to guarantee directly the quality of cement produced by its members, has very adroitly accomplished the same thing by adding to its Constitution and By-Laws the amendment above mentioned.

This action of the Portland Cement Association perhaps typifies its service to the public in a way that will be more readily grasped by people at large than any other one item of practice or policy under which it operates. President L. T. Sunderland, of Kansas City, Mo., who was re-elected at the Annual Meeting, in commenting upon this amendment, says: "This only serves as a further protection to the cement buying public. Portland cement always has been a highly standardized product but as varying degrees of skill have been displayed in so-called tests of cement made by people not thoroughly grounded in testing practice through lack of long and competent laboratory training, misleading results have often been announced. The public can now feel assured that if the cement is produced by a member of the Portland Cement Association, that fact is an added endorsement of quality and actual assurance that it will measure up to the accepted engineering standards, since otherwise membership in the Association would be thereby jeopardized."

Re-elected with President Sunderland were Richard Hardy, First Vice-president, Chattanooga, Tenn.; S. B. Newberry, Second Vice-president, 818 Engineers Building Cleveland, Ohio; and F. W. Kelley, Treasurer, 126 State Street, Albany, N. Y.

The following directors were also elected: H. Struckmann, 342 Madison avenue, New York, N. Y.; Charles F. Conn, 603 Pennsylvania Building, Philadelphia, Pa.; H. L. Block, Post Dispatch Building, St. Louis, Mo.; W. M. Hatch, Union City, Mich.; George T. Cameron, Crocker Building, San Francisco, Calif., and David M. Kirk, Wampum, Pa.

Hollow Wall Concrete Construction

"The 'Frost' concrete form is a form used for constructing any hollow or solid wall concrete building at a cost much less than the ordinary expense of construction, where temporary forms of any kind are used," writes H. T. Frost, president, Hollow Concrete Wall Co., Mitchell, S. Dak.

Farm buildings, bungalows, houses, garages, factories, ice houses, foundation walls etc., can be constructed with this form at a material saving over cement block, tile, brick or wood construction.

It is the simplest, least expensive, and most rapid method of hollow wall construction in existence. One operator can build as rapidly as three men can mix and carry the concrete to the form. There is no delay in waiting for the concrete to set. Simply spread and tamp the fresh concrete in the forms until filled, then raise the lever releasing the forms from the wall, move it forward, reclamp on the wall and repeat the operation.

The forms are so simple in construction and operation that any person of ordinary intelligence can learn to operate it in one hour.

Hollow concrete walls constructed with "Frost" Concrete Forms are storm safe, fire proof, insulated from heat and cold, and absolutely impervious to moisture, making a very suitable construction for dwellings and many other buildings in which these particular points are very essential.

It will build a hollow concrete wall with continuous air space of 2½ inches.

It will build a hollow concrete wall with solid corners.

It will build a hollow concrete wall with solid pilasters at any desired place in the wall.

It will build hollow walls of any desired thickness from seven to fourteen inches.

It will build solid foundation or partition walls of any desired thickness from two to fourteen inches.

It will build irrigation ditches, flumes, curbs, posts, columns, and many other forms in which concrete is advantageous.

It builds 10 inches high each course.

The Frost Hollow Wall Forms are scientifically built which insures the walls being true and straight when completed. No skilled labor required. Method has been tried and proven. Write for complete description of Method and its operation, photos showing work done, and costs.

The Anchor One-Man Brick Machine

The simple and substantial brick machine manufactured by the Anchor Concrete Machinery Co., Rock Rapids, Iowa, can be furnished with power tamper or with automatic hand tamp device.

Concrete Garage in Ellendale, N. Dakota built by Stahl-Finkle Co., contractors. The walls have a continuous air space 2½ inches wide. The outer wall is 4 inches thick and the inner wall 6 inches thick with the usual 2½ inch air space between. Pilaster and belt projections are 4 inches. This construction seems ideal, for two walls are obtained with no connections whatever, save 3/16-inch rods for ties at intervals. The whole building has no mortar joints, and is practically as strong as of monolithic.

The aggregate used for the walls was bank run material not screened, and cement used in the proportion of 4½ to 1.

Both interior and exterior of building were plastered and the panels outside were stuccoed on the plaster.

"Making ten bricks at each operation, the machine will produce more brick per man than any other equipment," writes the Anchor Company.

"Being a down face machine this will make the very finest-faced and ornamental brick—yet no speed on common brick is sacrificed. Plain wood pallets used.

"Special pallet release, involving no springs or clips, practically eliminates breakage so common on other machines.

"Upon investigation you will find that with this little outfit, or battery of such outfits, you can produce brick more cheaply than with any large all automatic machine. And at the same time you do not have a large amount of money invested and are not subject to repeated shutdowns on account of necessary repairs. Think it over."

Preparing Iowa Sand and Gravel for Market

Plant Has Capacity of 375 Tons an Hour

The Ideal Sand and Gravel Company, of Mason City, Iowa, are producing from a 260-acre deposit of sand and gravel and are working the property with three Monighan dragline machines which are operating at three different points.

Their dragline machines are used both for removing the 1½ ft. of soil overburden and for excavating the gravel. One machine has a 1½-yd. bucket; the other two have buckets of 2½-yd. capacity.

As the gravel is dug it is emptied by the excavators into open-top bottom Continental dump cars, having a capacity of 50 tons, which operate over standard-gauge track. After cars are loaded they are transported by a 40-ton Vulcan locomotive to a central track hopper and dumped. From this hopper the material is elevated by a 30-in. Hettrick belt conveyor to the crushing house.

The belt conveyor empties the material into a revolving screen with 2-in. openings. The gravel that is rejected passes into a gyratory crusher, and is again returned to the screens.

Another belt conveyor carries the material that passes the screens to the washing bins, where the washing operation is performed with water that is flowing at the rate of 1,600 gallons per minute. This water is pumped by an American Well Works Centrifugal pump through a 1,500-ft. long pipe line (Robertson Bros. Mfg. Co. lock-seam spiral pipe used) from a natural reservoir.

After the washing process has been completed the material is ready for shipment, and can be loaded directly from the wash house into railroad cars on one side and into trucks and wagons on the other side. The plant has a capacity of 375 tons per hour.

One of the special features of this plant is the storage facilities. From 50,000 to 75,000 tons of material ca neasily be accommodated in these yards, which enables the company to make prompt shipment. These storage yards are served by a Link-Belt locomotive crane.

All of the material-handling equipment used by this company is fitted with wire rope, manufactured by A. Leschen & Sons Rope Co., St. Louis.

The product of this plant is supplied to a large territory surrounding Mason City, and in addition to sand and gravel the company is also producing limestone on its property, for agricultural purposes.

Excavating and Loading Gravel in the Pit of the Ideal Sand & Gravel Company.

Drain Tile Specifications

The American Society for Testing Materials has presented its specifications for Drain Tile to the American Engineering Standards Committee for consideration and approval as Tentative American Standard.

The history of these specifications dates back to 1911 when the A. S. T. M. organized its Committee C-6 on Drain Tile to meet two very urgent conditions. The comparatively recent use, on an extensive scale, of very large drain tile in public drainage works for reclaiming wet lands had brought about the unexpected discovery that these large drain tile were quite subject to cracking in the ditch under the weight of the ditch refilling. Also, the extensive production of concrete drain tile, and the resulting controversy between clay tile and concrete tile producers as to the

merits of the new material made it urgent that additional data be secured.

The first task of the newly organized committee was to plan and conduct a series of investigations covering methods of tests, the determination of desired quality and durability of drain tile, and a study of methods of manufacture and of construction and field specifications. In this work it was actively assisted by the following Engineering Laboratories:

Iowa Engineering Experiment Station, Ames, Iowa.

Municipal Testing Laboratory, City of St. Louis, Mo.

University of Wisconsin, Madison, Wis.

Lewis Institute, Chicago, Ill.

Engineering Laboratory of Edward Orton, Jr., Columbus, O.

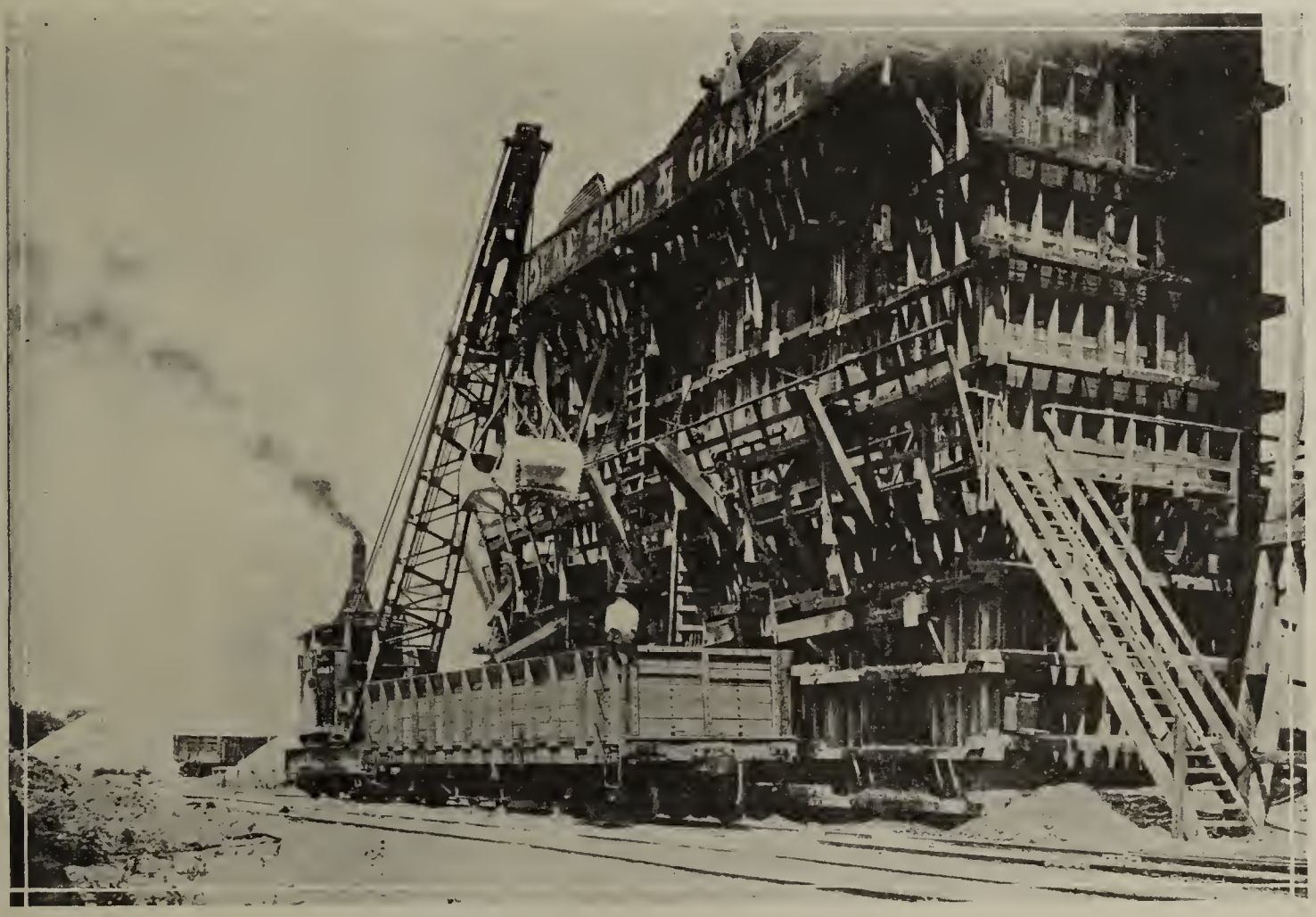
The manufacturers of clay and concrete tile cooperated by furnishing materials for tests. The American Society for Testing Materials estimates that these investigations, which extended over five years, from 1911 to 1915, cost at least $25,000.

In 1914 Committee C-6 prepared Standard Specifications for Drain Tile covering strength tests, quality and requirements for strength of tile as used in ditches. These specifications were tentatively adopted, subject to revision. The specifications were revised in 1916 and 1921, the latter revision consisting of a modification of the methods of making the freezing and thawing test as the result of investigations which had been under way for some time.

The specifications are submitted to the American Engineering Standards Committee in accordance with the special provision in the procedure of the Committee under which important standards in existence prior to 1920 may be approved without going through the regular process followed in New York.

The Committee would be very glad to learn from those interested of the extent to which they make use of these specifications and to receive any other information regarding the specifications in meeting the needs of the industry.

The revised specifications are contained in the 1921 volume of A. S. T. M. Standards. Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th Street, New York City. Price 25 cents.



The Washing Plant and Locomotive Crane of the Ideal Sand & Gravel Co., Mason City, Iowa.

Concrete Proportioning Tests

In a thesis presented for the Degree of Bachelor of Science in Civil Engineering of Washington University, R. E. Salveter and E. J. Schewe investigated some of the current methods of proportioning concrete and arrived at the following conclusions. The colorimetric test for organic impurities in sand does not furnish an accurate basis for determining whether or not a sand is unfit for use in concrete. The slump test apparatus is very unreliable, especially in leaner concrete mixtures. There is need for investigations to disclose whether the consistency of concrete is dependent upon the surface area of the aggregate or upon some function of the fineness or grading of the particles. The water content in concrete is the most important single factor influencing strength, though the effect is more pronounced in early ages. The water-cement ratio has proved the most satisfactory of any of the methods for considering the water content of the concrete mix.

Portable Belt Driven Air Compressor, for Operation by Tractor

The Sullivan "WK-34" Portable Belt Driven Air Compressor, for operation by tractor, as shown in the illustration herewith, is a portable compressed air unit, consisting of one Sullivan size 8x8 inch standard straight line belt driven air compressor, having a displacement capacity of 121 cu. ft. of free air per minute, and designed to run at 260 r.p.m., and to furnish air at 90 lbs. pressure, at which pressure 18.3 horsepower will be necessary for the operation of the compressor.

The compressor will be equipped with an idler pulley of suitable diameter, mounted upon a bracket hinged to the front end of the compressor frame between the flywheels, to permit short center drive.

Adjoining to and in line with the air cylinder, will be located an air receiver 26 inches in diameter, and 33 inches long. The compressor and receiver will be mounted upon a rigid steel truck mounted on wheels for hauling the machine from place to place.

The air compressor will be of the standard type, as described in specification Form No. 1212 in all respects, except that the regular air cylinder will be replaced by one having an open hopper jacket instead of the closed jacket construction. This will permit cooling of the cylinder by means of water poured into the hopper jacket at the top by means of a hose or bucket.

The truck body will be similar to that supplied on the Sullivan Gasoline Engine Driven Portable Compressor Class WK-31. The body will be made of 9-in. channel irons strongly braced. The axles will be made of double five-inch channel irons. The front wheels will be 32 inches and the rear wheels 36 inches in diameter, with cast iron hubs, oval steel spokes and steel rims of five-inch face.

The track gauge will be 4 ft. 8 inches. The rear axle will be heavily braced to the truck body, and rigid braces and tie rods underneath the center of the body will add to the stiffness of the construction. The front axle will be furnished with a heavy fifth wheel and swivel bolster, which will enable the truck to travel over rough ground without producing twisting strains in the truck body. A pole with suitable connection for attachment to a tractor will be furnished.

The entire outfit will be protected from the weather by a strongly braced top supported on the truck frame. This will be provided with canvas side curtains which may be rolled up out of the way when the outfit is working.

This outfit is designed to be operated by a Fordson or other similar type of tractor. The illustration shows the position by belt from a pulley on the tractor to the pulley of the compressor. A distance piece or connection bar for maintaining the proper belt tension will be supplied with the compressor.

The belt tightener will be equipped with a spiral spring while will prevent slapping action of the pulley on the belt in case of change of tension of the belt.

A suitable water-proofed leather belt of proper length for the operation of the machine will be supplied with it.

The net weight of the compressor complete without oil or water, will be about 4,100 lbs.

A Ditch in a Hurry

In these times of labor supremacy when everybody wants a "think" job bossing somebody else, it is next to impossible to employ ditch diggers and any labor saving method of ditching deserves serious consideration.

A description of the way the ditch shown in the accompanying picture was recently dug on the farm of F. M. Gaines near Dothan, Alabama, should prove of interest.

The ditch is 750 feet long and averages 7 feet wide and from 3 to 5 feet deep according to grade. It was cut through a bay and gum swamp covered with water and a great many logs littered the surface and were submerged through out its course. There were also many cypress, pine, bay and gum stumps, also many small saplings in the line. None of the logs, stump, or small growth were removed by hand.

The ditch was blasted with forty percent ammonia dynamite. Holes were punched in the earth 30 inches apart and 2½ to 4½ feet deep depending upon desired grade. The shallow holes were loaded with a half to three-quarters of a pound of dynamite and the deeper holes with from a pound to a pound and a half of the explosive. No tamping was necessary as water filled the holes. An electric blasting cap was inserted in each charge and the charges connected together in series by means of the cap wires. As a No. 3 blasting machine was used to fire the charges, it was necessary to do the work in thirty hole sections because that is the capacity of the blasting machine used.

Where stumps, logs and trees were encountered in the line of the ditch, oblique holes were punched so as to get the charges under the stumps or logs and heavier charges were used than where it was merely necessary to blast earth. With that exception, the work was done the same way where these obstructions were encountered as in places where only the earth had to be blasted.

The total cost of the ditch including labor was $105.00 or 30 cents per lineal yard.

The Carroll Chain Company

The Carroll Chain Company of Columbus, Ohio, was incorporated on November 1st, 1921 for the purpose of engaging in the manufacture of a complete line of welded chain. Capital stock to the extent of $100,000 was promptly subscribed and ground broken for the erection of a high class modern plant. Entirely new equipment of late design will be installed as rapidly as the building progress permits.

The company contemplates the production of both fire-weld and electric weld chain, but will begin operations by confining the manufacture to fire-weld varieties, giving special attention to steam shovel and dredge chains.

Daniel Carroll, the president of the new corporation, is a pioneer chainmaker of Columbus, and a man who has devoted an active life to the development of the chain industry. He was one of the organizers of the Columbus Chain Company in the year 1900, which company is now the Columbus McKinnon Chain Company. Mr. Carroll's many friends throughout the country will be interested to know that he is the active manager of the new enterprise.

The company has the advantage of entering the field with an operating organization of men trained and experienced in the chain industry. The treasurer is G. G. McAlister, whose seventeen years of association with the chain business amply qualifies him for the office.

The sales end of the business is entrusted to J. M. White who is secretary of the company, also. Mr. White is well known among hardware jobbers in a considerable portion of the country, having covered a large territory in a sales capacity. He was associated with the Johnson Sales Company of Pittsburgh for eight years, leaving that company to assume sales duties with the Columbus McKinnon Chain Company.

The company expects to be producing some varieties of chain within sixty days.

Electrically Operated Drill

A change was recently made from gasoline to an electrically operated drill in the quarry of the Mid-West Crushed Stone Company, Greencastle,Ind., with some results that were surprising. Previously the driller worked day and night in his efforts to keep holes drilled in advance of their being called for. An effort was made to pipe steam to the drill but this was abandoned because of the loss of power occasioned by the long pipe from the power house to the drill, which was usually over a quarter of a mile.

Electricity was found to be much cheaper than steam and is always "on tap" and does its work effectively. Since changing to electricity the drill man works days only as he is always ahead of the needs of the quarry.

The 5-inch Big Blast hole drill used, sinks a hole about 55 ft., the height of the quarry face. The drill is now working on a series of holes which will soon be fired.

A 2-in. cable is used to operate the drill. Due to the sudden "take hold" and "let go" of the drill, the rope gradually "burns" out. Rope used on drills is subjected to unusually severe strains which causes the rope literally to burn out in a relatively short time.

Effect of Sea Water on Concrete

Sir.—I have read, with much interest, C. E. W. Dodwell's article, in the May, 1921, issue of your paper, on the effect of sea water on a concrete structure. Mr. Dodwell is quite correct is ascribing the difficulty partly to the fact that the concrete was porous. I note that his concrete was composed of one volume of cement, three of sand and three of stone.

When I want an impervious concrete, I always specify that the volume of the sand shall be no more than twice the volume of the cement, otherwise the voids in the sand will not be filled. For this purpose I would much rather have a 1:2:5 mixture than the 1:3:3.

I have often noticed that heat greatly accelerates the disintegration of concrete. This is a matter of record by others; for instance, at Panama concrete is much more apt to disintegrate than in this climate.

It has always seemed to me that the porous concrete and chemical impurities are very much more apt to destroy the concrete than sea water by itself.

At a power station in this city, where the chemical impurities discharged are very hot, the concrete deteriorated so rapidly that all effort towards getting any brick or concrete masonry to withstand this action was given up, and a timber lining was utilized, with good results.

A sea wall in Long Island Sound has one side opposed to the storms from the whole length of the Sound, while the inside is subject to calm water, to the heat of the afternoon sun and to possible sewage polution. After some eight or nine years, it was found that just above the low water mark the concrete was badly rotted for the depth of one foot on the inside of the sea wall, while the outside of the wall was still in perfect condition. In this case, the rich mixture of sand and cement made the chemical action very slow.

T. KENNARD THOMSON,
Consulting Engineer.

New York City.

New Cement Manufacturers Directory

The 1922 edition of the "American Cement Directory" of Portland Cement Manufacturers, published by the Bradley Pulverizer Co., Allentown, Pa., will soon be off the press and will be mailed to those who have placed their orders for it. This year's book is the result of greater care, both editorially and mechanically, than ever before, and is believed to be as near perfect as such a book can be. It is uniform in size and style with previous issues, and follows the same general style of composition which has become familiar to users of this Directory.

A complete list of officers of cement plants is one of the valuable features of the book, this list comprising hundreds of names.

The price of the book is one dollar.

A New Sand and Gravel Washing Plant Well Planned and Carefully Executed

The large gravel washing and screening plant, owned and operated by the Anderson-Theobald Co., Vincennes, Indiana, is an example of an installation well planned and carefully executed. Every detail of operation was given consideration when the enterprise was in its preliminary stages and before contracts for any equipment or building were closed.

In contemplating the erection of a sand and gravel project, there are points of vital importance which must be very clearly understood in the mind of the promoter, and secondly, well advanced in the opinion of the engineer.

Primarily, there must be a market and every possibility of an increasing demand for the materials produced.- Second, consideration must be given to the practicability of economically producing the desired size and quality of material. Bank run gravel varies greatly in its composition, even in particular districts. The aggregate contains oftentimes certain sizes in excessive percentages, rendering the marketing of the product altogether impracticable.

It is the desire of CEMENT AND ENGINEERING NEWS to impress upon prospective promoters of sand and gravel projects, the importance of securing expert advice on such projects before completing on plans and arrangements. We can put you in touch with pioneers in this line and their engineers are versed in every phase of the gravel washing and screening business. Their experience in designing plants of most every description for this class of work has given them the opportunity to gather a wealth of information concerning the industry. It is this data which enables their engineers to offer excellent advice to builders of gravel plants.

The several half-tone illustrations herewith give an excellent idea of the plant with its several units, the track hopper, belt conveyor galleries and screened machines mounted over the storage bins.

The aggregate is dumped from large cars into the big concrete track hopper. The hopper is built with heavy grizzly bars which protect the conveyor from boulders. The hopper is large enough to hold several carloads of material and the material is fed to the belt conveyor by means of a special gate operated by a hand lever from the track level.

The inclined belt conveyor is 30 inches wide. It is especially notable to see the uniform loading of the belt as illustrated herewith. Uniform loading of the belt conveyor is highly desirable. It means maximum capacity and long conveyor belt life. These two points are of utmost importance in not only large installations, but in every case where belt conveyors are used. The material is dumped at the head end of the conveyor into a large chute which divides the aggregate, sending half to one series of screens and the other half to a second series of screens. There are eight Gilbert Screens, arranged in pairs, which take care of the separation, the oversize discharge from each screen being dumped directly into the storage bins beneath, and that material which passes the per-

View of Inclined Belt Conveyor and Gravel Washing and Screening Plant. Insert—Wood-Lagged Head Pulley of Belt Conveyor.

Another General View of Washing and Screening Plant, Anderson-Theobald Co., With Belt Conveyor at Left.

forations being introduced into the next pair of screens.

The best principle for a washing plant is one that will roll and tumble the sand and gravel in a rapidly running stream of water. At the same time it should also size the gravel and allow the oversize to be separated and the material passing the screen to be introduced into a second screen. The most practical

Close-Up View Showing Concrete Track Hopper and Belt Conveyor.

example of this principle is found in the Gilbert screen, which was originally patented by Mr. W. S. Gilbert, an old mining man.

The Gilbert screen is conical in shape, entirely open at one end and supported on a horizontal axis. A chute delivers the gravel and water to the extreme interior of the screen, and the material agitated by the revolution of the screen works its way out against a jet of water and is thus thoroughly washed and screened.

The gravel plant at Vincennes, Ind., was designed and built by the J. C. Buckbee Company, First National Bank Bldg., Chicago, Ill.

Pulverized Fuels

A bulletin entitled Pulverized Fuels has just been published by the Hardinge Co., 120 Broadway, New York, N. Y. This bulletin is known as their No. 9 catalog.

The adoption of the Hardinge mill for pulverized fuels is comparatively recent according to their own statement, as follows:

"The Hardinge conical mill, although only recently applied to this field, has been fully demonstrated as a most satisfactory unit for pulverizing solid fuels. The results obtained are a continuation of the remarkable record of the Hardinge mill in the mining and industrial grinding fields, as evidenced by the fact that over 70,000,000 tons of friable materials are being ground per year in Hardinge mills alone.

This bulletin is divided into three main sections, viz., the application of pulverized fuel to various burning problems, the principle of operation of the Hardinge mill, and a discussion of the application of the Hardinge system for pulverizing fuels.

Under the heading of Pulverized Fuel, three principal causes are mentioned why the advance of this class of fuel has been so rapid in the last few years. These reasons are:

a—The increased efficiency of combustion.

b—The utilization of fuels which would otherwise be wasted or be very inefficiently burned.

c—Flexibility of operation and ease in handling making it possible to control the burning within a wide range on short notice.

In the general discussion of pulverized fuel where the Hardinge system is used, emphasis is laid upon the point of "sparking" during the burning process. They emphasize the point that when coarse oversize of from 65 to 150 mesh, depending upon the character of fuel, is eliminated, "sparking" ceases, and when this oversize is eliminated by a satisfactory means, it is not necessary to grind to a degree of fineness which was at one time thought necessary.

Under the subject "The Hardinge Mill," the general principle of grinding is discussed, with special reference to stage reduction, elimination of the fine particles as soon as produced, and the proportioning of energy to the work required. The different types of Hardinge mills and the details of their construction are also discussed in this section, and special reference is made of the advantages of the conical mill when used for pulverized fuels of widely different character.

Under "Pulverized Fuel Installations," a complete pulverized fuel plant is outlined, which includes the feeding of the coal from the track hopper to the crushers, dryer, mill, separator and distribution system. There is also taken up different arrangements of the mill and separator which would be used according to the special requirements. In addition, there is given a table showing the general dimensions of the different sizes of Hardinge mills so that it is possible to make a rough estimate of the floor space required for each unit.

Quick Hardening Cement Developed By the French

New Fused Product of High Alumina Content Should Prove of Value in Many Kinds of Construction

By Edwin C. Eckel, Consulting Engineer, Washington, D. C.

In the course of the World War a cement of very remarkable type and properties was put into use by the French for special military purposes. Its high technical value, in certain limited fields, is such as to make it advisable to briefly discuss its characteristics. As an introductory summary we may say that it is a lime aluminate, differing from normal portland cement in the almost total absence of silica; that it is prepared by actual fusion, not by mere clinkering; that it is almost white in color; and that it will harden with such rapidity as to make a good heavy-gun platform within 24 hours. It will be seen that it offers certain possibilities for other than military uses; and that products of this general type may become of interest both to American cement manufacturers and to American engineers.

Of course it is well known here that, a decade or more ago, Messrs. Lazell and Spackman began investigating the possibilities of high-alumina cements, and took out a series of patents in connection with them. Some of the processes then developed have come into use, particularly in connection with the lime industry, where it was found that the addition of a lime aluminate aided greatly in giving a more rapid hardening to limes and lime plasters. But so far as I know, none of the products made for that purpose were ever, commercially, real aluminates of lime. They were made in the majority of cases from a furnace slag which carried abnormally high alumina, because it came from furnaces running on the brown iron ores from the north coast of Cuba.

What is less commonly known, however, is that a parallel series of investigations were being carried on in France, at about the same time, and that these have resulted in an entirely different series of commercial products. The French patents were taken out in 1908 by the well known firm of J. & A. Pavin de Lafarge, who are among the largest French manufacturers of both portland cement and hydraulic lime. During the war the A. E. F. operated some of the Lafarge plants, and while in charge of that work it was possible to observe the manufacture and characteristics of the fused aluminous cement which was being made at a neighboring plant for artillery mounts. Such notes on the subject as seem of general interest are presented here.

Lafarge Fused Cement

The Lafarge quick-hardening aluminous cement was marketed as *ciment fondu* or fused cement, and for the sake of brevity that term will be used hereafter in this article.

The fused cement is made in a small blast furnace, which is charged with coke, limestone and bauxite. When the furnace is in steady operation it turns out from ten to fifteen metric tons a day of fused slag of clinker. This slag, cooled and ground, is the Lafarge fused cement. In composition it does not vary greatly from

Lime	50 per cent
Alumina	40 per cent
Silica, etc.	10 per cent

The silica noted comes in chiefly from the impurities of the coke, but in lesser part from the bauxite, and to a very slight extent from the limestone used. The fused cement, as will be seen from the above note, is far lower in lime than the normal portland cements, a characteristic which it shares with the high-iron cements occasionally made and used.

So far as cost of manufacture is concerned, the fused cement can obviously be made at least as cheaply as a normal portland. Its uses will be determined then, not by cost, but by its special characteristics, which give it value in certain fields of work, but limit its use in other lines. We may note briefly some of these characteristics.

Setting, Hardening and Strength

The fused cement has a normal setting time, falling in this regard within ordinary portland cement specifications. It can therefore be mixed and worked without taking any extraordinary precautions.

Its hardening, however, takes place with far greater rapidity than does that of a normal portland cement, so that a 24-hour test will give results for the fused cement which are rarely obtainable with portlands under 28 days. In saying this it must be kept in mind that I am speaking of French cements used in French climate. The average American portland, used in the United States, will both set and harden faster than the usual European portland employed abroad.

Laboratory tests on the fused cement gave the following results, the briquettes and cubes being made up of a 1:3 mixture of cement and sand.

Resistance In Kilograms Per Square Centimetre

Age	Tension	Compression
1 day	29 kg.	352 kg.
2 days	34 kg.	387 kg.
3 days	34½ kg.	400 kg.
7 days	35½ kg.	451 kg.
28 days	37½ kg.	475 kg.

Obviously there are great advantages in the use of a quick-hardening cement of this type under special conditions. For marine work which is to be completed between two tides we have available a satisfactory material, and as will be seen later it is also a cement resistant to marine action.

Resistance To Decomposition

Considering the composition of the fused cement, its most remarkable property perhaps is its resistance to the decomposing effects of sea-water and similar solutions, for until the Lafarge cement was introduced there was a tendency to ascribe the breaking up of portland cement in sea water to its content of alumina, and to search for cements low in alumina. Yet here we have a cement with a very abnormal alumina content which seems to be perfectly resistant to marine action.

The Paris-Lyons-Mediterranee R.R. used fused cement on a portion of its line along the Mediterranean, where normal cements are badly affected by exposure to sea air and salt water; and the fused cement is reported to have stood the exposure admirably.

In laboratory tests, for which records of nine years' standing are now available, the fused cement has been kept in three solutions: (1) Sea water, (2) water saturated with lime sulphate and (3) water carrying 1.2 per cent magnesium sulphate. The cubes kept for nine years under these three very trying conditions are absolutely intact.

Briquets of neat cement, composed of fused cement to which gypsum was added in all proportions up to 50 per cent, have been kept in water since 1908 without the least signs of disintegration.

In view of these facts it seems evident that we must

WITH THEIR PATENTED TELFAX TAPE MARKER

"WILLIAMSPORT"

Reveals to you the Greatest Advancement of all times in the making of Wire Rope

—and settles forever today's greatest problem in the wire rope industry, by making it possible for anyone to identify the various grades of Williamsport wire rope without an exhaustive and expensive laboratory test.

Beginning November, 1921, every inch of Williamsport Wire Rope contains a distinguishing Telfax Patented Tape Marker, built right through the core of the hemp center, indicating clearly, by distinctive design and color, the various grades of wire rope.

No greater achievement has been accomplished since the beginning of wire rope manufacture. It takes from the industry, as far as Williamsport is concerned, all mystery, all uncertainty, all doubt.

It enables the purchaser to buy with the assurance that their receiving department can tell exactly what has been received, and the superintendent, directly responsible for the lives of his workmen and the efficiency of his equipment, can now see instantly, for himself, that he has received exactly what he has asked for.

This Telfax Patented Tape Marker is Your Protection

Thus Williamsport stands alone in giving to the dealer and user a protection of vital, far reaching importance. And it places upon us a greater responsibility to exercise even greater diligence in keeping the quality worthy of the name it bears.

Never again will you need to feel concerned about the grade of wire rope you get, if you specify and insist upon getting WILLIAMSPORT, Telfax Tape Marked, for substitution cannot take place with Williamsport Wire Rope so marked, no matter

—How many hands it passes through en route.
—How many times it changes reels.
—How careless the warehouseman may be.
—How tricky the seller may be.

If you want to be certain of getting the grade of wire rope you buy—specify "Williamsport". Send today for your Telfax color chart and other literature on this Modern Wire Rope.

WILLIAMSPORT WIRE ROPE COMPANY

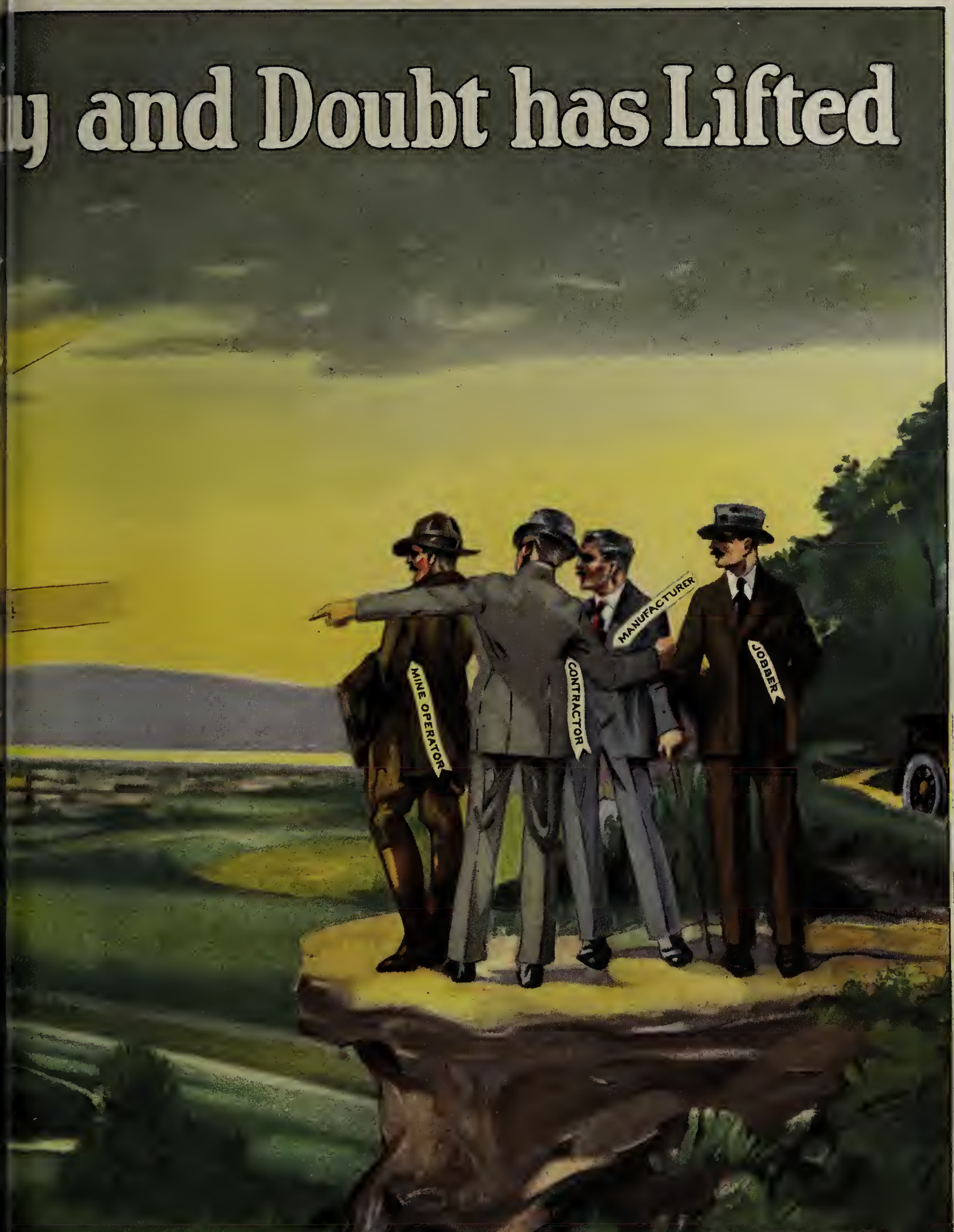
Main Office and Works
Williamsport, Pa.

"accepted as the best"

General Sales Office: Peoples Gas Bldg.
Chicago, Illinois.

TELFAX MARKERS ARE PATENTED IN THE

y and Doubt has Lifted



VIRE ROPE You Buy —if You SPECIFY

ISPORT

ker that absolutely prevents Substitution

AND CANADA. FOREIGN PATENTS PENDING

You have been GUESSING on the grade of wire rope you have received ever since Wire Rope has been made. Now is the time to STOP IT. Specify WILLIAMSPORT with these Telfax Tape Markers in them — they will absolutely safeguard your purchase.

Write today for your Telfax Color chart and an interesting booklet on Modern Wire Rope

Williamsport Wire Rope Company

GENERAL SALES OFFICES
PEOPLES GAS BUILDING
CHICAGO

PLANT
WILLIAMSPORT
PENNSYLVANIA

WAREHOUSES IN ALL CONVENIENT LOCATIONS IN AMERICA

broaden our ideas as to the possible modes of securing protection of cement against the action of sea water and of other strong solutions. I was not able to secure data regarding the resistance of the fused cement against highly alkaline or acid solutions, a matter which is yearly becoming of greater industrial importance. It is to be hoped that some laboratory which has the facilities for carrying out such tests may take up the matter in proper detail.

To sum up the matter, we are dealing with a cement of entirely new type, which seems to be well worthy the consideration of American engineers and chemists. None of the Lafarge fused cement has ever been shipped into this country; and no cement of that type has, so far as I know, ever been made here by anyone else. In view of the history of the Spackman and the Lafarge patents, it is questionable as to how far any patent rights can now cover the product above described in the United States. The commercial side of the matter is therefore uncertain; but as a technical affair it is certainly worth more attention than has been given to it heretofore.

Possibilities in Fused Cement

Sir—The foregoing article by Mr. Eckel on "Quick Hardening Cement Developed by the French," calls to the attention of the engineering public of this country a product which is, as he states "certainly worth more attention than has been given to it heretofore." Abroad this material has during the past several years received considerable attention, as evidenced by the paper of Endell, entitled "Cement Rich in Alumina," read before the 1919 meeting of the Portland Cement Association, and an article by Bied dealing with the use of this material in reinforced concrete, published in "Revue de l'Ingenieur," 27-191. I have also called attention to some of the work along this line, which has been done by the Bureau of Standards, in a paper presented before the American Society for Testing Materials, in 1919. It is now being issued by the Bureau as Technologic Paper No. 197, in this form giving complete data obtained in testing a series of cements of this type manufactured by the Bureau. The tests extended over a period of five years and showed the results obtained by using the cement both as a mortar and a concrete, under various conditions of storage.

In every way the tests fulfilled the results which have been obtained abroad, with the sole exception that it was not found satisfactory to use any in concrete which would be subjected continuously to water. As a cement for reinforced concrete they would have much to justify their use over portland cement on account of the very rapid hardening, which as Mr. Eckel states, in twenty-four hours gives results which are rarely obtained with portland cement under twenty-eight days.

The French refer to this cement as fused cement, and call particular attention to its being made in a blast furnace. Our results would lead us to believe that this procedure is not one that has been used because it would give a particularly good cement, but rather one caused by manufacturing conditions. A reference to the work of Rankin, which is the fundamental work in all portland cement investigation, would reveal the fact that a mixture of alumina, lime, and silica of the composition cited by Mr. Eckel, and apparently used by the Lafarge company, will fuse at a temperature of about 1,380 degrees. This temperature is about 50 degrees lower than that used in this country in portland cement clinkering. In the Bureau's work but one difficulty was encountered, namely, preventing the material from fusing. A rotary kiln was used in which it was thought desirable to produce a clinker instead of a fused product, on account of the greater ease of reducing a clinker to a ground product. The control required under these latter conditions is far more exacting than would have been required to have fused the mix, especially when compositions approaching that used by the Lafarge company were used.

There is no question about the many remarkable qualities which this cement has. So far as its production in this country is concerned, however, it is largely a matter of source of raw material. If alumina in any form would be available in large quantities near a market where such cement could be used, it would be found possible to produce these cements in an ordinary portland cement plant without any changes whatsoever.

It would be very befitting that this product should be manufactured in this country, as undoubtedly attention was first called to it by the work of Messrs, Spackman and Lazell.

P. H. BATES.
Washington, D. C., U. S. Bureau of Standards.

What Makes Cement Quick-Setting?

"I have followed with considerable interest the discussion on the probable causes of quick or flash-setting of portland cement. It appears that the phenomenon in question is not a true setting, but is only a stiffening of the cement within a very short time after mixing, which is then followed by the normal setting action," writes Claude R. Hill, Director of Technical Research on Oxychloride Cements (The Dow Chemical Co.) in "Concrete."

"In our study of the properties and reactions of magnesium oxychloride cements, we have observed frequent instances of flash-setting very similar to that discussed. A brief treatment of the subject may throw some light on the corresponding action of portland cement, although the underlying causes of the phenomenon may be, and probably are, different in the cases of the two cements.

"The normal setting reaction of the oxychloride cement with normal consistency and temperature usually starts after an apparently inert period of from 15 to 45 minutes, during which the impression from the testing needles flows shut. There is then a gradual hardening, with initial set at about three hours, and final set an hour or two later. This is shown in photographs which they have taken of test pat No. 1407, from the automatic setting-time machine. In test pat No. 1425 we have a sample which stiffens immediately at the beginning of the test, but the reaction then slows down and the initial setting time is normal instead of short, as would be expected from the first action. In this case also there is an abnormally long interval between initial and final setting.

"Upon tracing this flash-setting of oxychloride cement, we found it to be due to a contamination with a small amount of underburned, quick-setting material. A refractive index analysis shows the presence of about 10% of underburned, 50% of normal burned, and 40% of overburned magnesia. The latter accounts for the slow final set. This internal non-uniformity of the magnesia may be the result of either improper kiln design or too large lump size of the magnesite passing through the kiln.

"It is evident that the underburned material reacts with its usual rapidity, and would produce a true rapid setting but there is not enough of it present to give sufficient hardening to support the testing needles, and the indicated setting is the result of the action of the remainder of the material."

Concrete Burial Vault Industry

The use of concrete burial vaults during the last few years has increased at an astonishing rate, and the next few years will witness even a greater increase in the concrete vault business than has been witnessed during the past. There are a number of reasons for this, among which might be mentioned that the development of the concrete industry has created a demand for concrete products of all kinds—burial vaults included. Then there has never been a period during which the undertaking profession has made a great progress in all of its departments as it has made in the last ten years, consequently a much higher grade of funeral furnishings of all kinds are being used now than ever before, and therefore there has been a increased demand for a higher state of perfection in burial vaults. Then again, the public in general is being educated out of the old-time method of burying with only an ordinary wooden box to protect the remains, and along with this education has come a spirit of investigation on the part of the people as to what kind of a burial vault is best. The result of all this is that the concrete vault is more in demand than any other.

The Automatic Sealing Vault Company, has not been slow in realizing the truth of the above statements and has spared neither time nor money in bringing its automatic sealing vault up to the highest standard of perfection.

The Automatic sealing vault is constructed on a plan entirely different from any other concrete vault, as no cementing of any description is necessary to exclude the water. The automatic seal is secured by the simple act of placing the cover in position on the body of the vault, which extends up into the cover in such a manner that when the water in the grave rises to a certain height the air is sealed within the vault, consequently no water can enter, as two bodies cannot occupy the same place at the same time. These facts give the Automatic sealing vault individual characteristics which places it in a class entirely to itself.

Any person who is interested in the manufacture of burial vaults will find it to his advantage to write the Automatic Sealing Vault Company, 216 East River St., Peru, Ind.

Osgood Chicago Office

The Osgood Company, of Marion, Ohio, announces the opening of a branch sales office at 1211 Conway Bldg., Chicago, Illinois, Telephone No. State 5960, which will be in charge of Arthur B. Sonneborn, as manager.

This announcement will be of particular interest to Osgood customers and contractors in and around the vicinity of Chicago, inasmuch as they will be able to get full information regarding Osgood steam shovels and excavating machinery direct from the Chicago office.

Hydrated Lime in Cement Blocks

Some time ago a concrete block manufacturer visited our offices and said he had been having considerable difficulty with the blocks manufactured by his firm, due to the necessity of working the material very dry. His output was low, owing to the difficulties of molding, and also because many of the blocks broke in handling after being molded. He had also received many complaints about his blocks being porous and the structures they had been used in were damp. After explaining his troubles, he asked if there was any way of overcoming them. After analysing his difficulties, the use of hydrated lime was explained to him, and he promised to give it a fair trial.

Better Blocks Made Possible

Later, this manufacturer came back to our offices for a friendly visit. He had used hydrated lime and converted what appeared to be a business failure into a success. According to his reports, he was able to turn out more and better blocks per day with the same labor as formerly. The manuipulation was simpler and fewer blocks were lost in stripping the molds, while a much better surface was obtained. Curing seemed to be more thorough and at the same time took a shorter period. He also said that the blocks were water-tight and that he had many favorable comments on the dryness of buildings in which they had been used.

Still another manufacturer wrote us as follows: "We had occasion a few days ago to examine some cement blocks made about a year ago in which hydrated lime was used in proportion of 1 to 4, and the blocks appear harder, denser, and of a better color than those in which no lime was used. We are now making some fancy columns, mixing with hydrate."

Benefits From Use of Hydrated Lime

Hydrated lime affords two distinct advantages to the cement block manufacturer. One advantage is that the mix is made more workable. It is well known that lime paste is very smooth and easy working. This property is imparted to the concrete when hydrated lime is added, the lime paste acting as a lubricant for the sharp, harsh cement and sand particles. Tamping is facilitated and consequently the forms are more easily filled. Special indented or modeled surfaces are much easier to make, and results in general are better.

The second advantage of hydrated lime in concrete blocks is that it is the most effective intergral waterproofing material known. The average mix used for cement blocks has a high percentage of voids due to poor grading of the material, and when molded by the dry or semi-dry process, these voids are not completely filled or sealed by the cement. The fine particles of hydrated lime, however, effectually seal these voids and thus make the product water-tight.

Proportions

Our recommendations for a 1:5 mix are 8 pounds of hydrated lime per bag of cement; 1:6 mix, 10 pounds; 1:7 mix, 12½ pounds. For convenience in measuring, it is well to remember that a six-quart pail, heaping full, will hold 8 pounds; an eight-quart pail, level full, holds 12½ pounds.

A more complete treatment of this subject may be found in Bulletin 302, issued by the National Lime Association, Mather Bldg., Washington, D. C. This bulletin is free and will be sent to anyone interested upon request.—Construction Lime News.

For the Practical Concrete Man

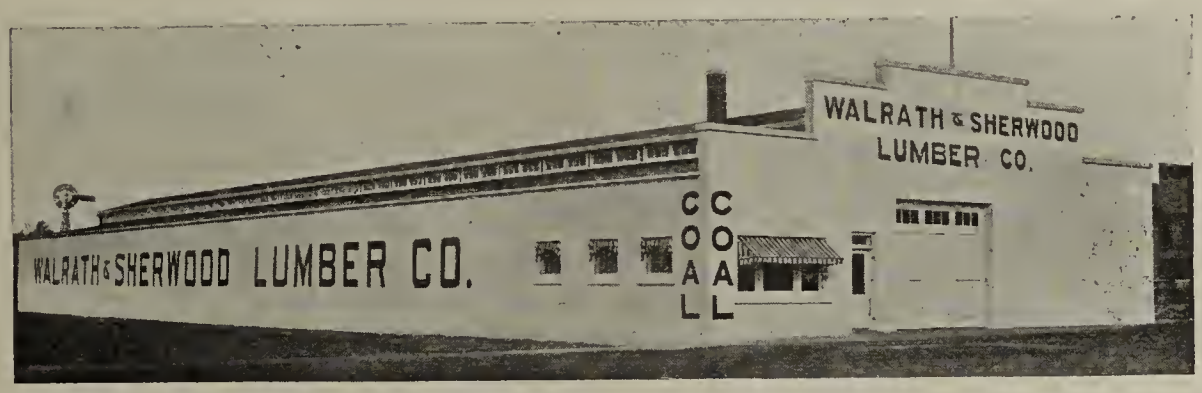
Concrete Work: Vol. II. A book to Aid the Self-Development of Workers in Concrete and for Students in Engineering—By William Kendrick Hatt, C.E., Ph.D., M. Am. Soc. C. E., M. Am. Soc. T. M. M. Soc. Prom. Eng. Ed.; Professor of Civil Engineering, Director of Laboratory for Testing Materials, Purdue University, Lafayette, Ind.; President, American Concrete Institute; and Walter C. Voss, B.S., Assoc. M. Am. Soc. C. E.; M. Am. Soc. T. M.; M. Am. Conc. Inst., Head, Department of Agricultural Construction, Wentworth Institute, Boston, Mass.; Licensed Architect, State of Illinois; Master Builder Boston. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth: 5x8 in.; pp. 206. Illustrated. $2 postpaid.

Vol. I of this novel treatment of concreting was reviewed about a year ago. The second volume is, according to the preface, prepared to develop the practical ability of the concrete worker, the inspector and the student in technical schools, which is effected by successive job sheets, beginning with the use of the triangle and continuing through methods of building a pile wall, determining where tension and compression occur in beams, of ascertaining proper location of reinforcing rods, and similar elements of the concrete art. No better book for the practical concrete man has been written, but it requires considerable study and experience on the part of the instructor to make it most effective for the student.

Warehouse Built of Concrete

About a year ago the Gordon, Nebraska yard of the Walrath & Sherwood Lumber Co., was destroyed by fire. In replacing it this company decided to guard against similar disasters in the future by erecting the large concrete warehouse shown below.

The structure is 75 feet wide and 210 feet long and



will store approximately three-fourths of a million feet of lumber and fifteen hundred tons of coal, beside a considerable stock of mill work and farm supplies. In constructing the building Medusa white cement was used over wood lath.

Big Blast Hole Drills

It has been stated that the best review that can be given a technical book is a sketch of the life work of the author. If this is true, then a new book or catalog entitled "Big Blast Hole Drills," a semi-treatise on blast hole drilling, just published by the Sanderson-Cyclone Drill Co., of Orville, Ohio, can be commended, for the Sanderson-Cyclone Drill Co., a pioneer in this class of work, claims to be the first manufacturer to convert the old style well drill into blast hole machines.

A bit of history is always interesting, and today deep blast hole drilling has become so common that the busy men of today have forgotten the crude methods followed a decade or two ago.

The writer remembers sinking blast holes 60 and 70 feet deep by the old churn drill methods, using a steel bit welded to pipe. First three men were used, then six, and as the hole got to be 40 feet nine men pulled the drill. Platforms and scaffolds had to be built for the men to work upon, and the drilling was both slow and expensive. A well drill was substituted for this crude method and also to save taking high ledges down in steps with percussive drills, and these well drills showed economical results.

The Sanderson-Cyclone Drill Co. heard of these results and at once got out a different drill point and string of tools to suit the new conditions; and as experience pointed out other changes, these were made in the machine, so that quarrymen, miners and contractors had a machine built especially for deep blast holes. It is little wonder that the experience thus gained has led this company to get out in the form of a catalog a treatise on blast hole drilling.

The book, gotten up in artistic style, is well illustrated with photographs. The book is divided into two parts. In all there are 96 pages, 9x12 inches in size. The first 64 are given over to details of drilling, while the last 32 pages are the catalog proper of the cyclone drills.

The first section treats of "The Big Hole Method, Its Origin and Development." This is followed by "The Advantages of the Big Hole Method over Other Systems," comparing this method with those of benching, snake holing, and tunneling.

Then "Factors and Conditions that Govern Big Hole Drilling" are discussed, followed by "Physical Properties of the Rock." This leads up to the "Physical Characteristics of Quarries, Mines and Rock Cuts" and the arrangement and spacing of drill holes. Much data is given on this important subject and several valuable tables.

This is followed by eight pages on costs and cost keeping, even giving some examples of cost record forms. Then 22 pages are devoted to the requirements of the big blast hole drill and how the Cyclone meets these requirements.

In the catalog proper, machines and tools are described and illustrated.

Literature on deep blast hole drilling is meagre, so that all interested in the subject will welcome this book for it is well written and covers many details and gives both the man operating a drill as well as his employer a vast amount of information that if applied to rock drilling will mean the saving of much money.

The purpose of publishing this book is clearly set forth as two-fold:

First: To give complete information on the fundamentals and essential factors of Big Blast Hole Drilling.

Second: To present a detailed description of the Cyclone No. 14 series of Big Blast Hole Drills.

Both of these things have been well done. A copy of the book can be obtained by asking for it.

1922 Edition Hendricks' Commercial Register

In these times of standardization we are always glad to see a publication adopt the size which is becoming the generally accepted standard. The latest convert to come to our notice is "Hendricks' Commercial Register." In its new size, 8½x11½ inches with a type size 7x10, it presents a greatly improved appearance. The text matter has been opened up leaving a space between the columns making it more readable as well as more attractive and giving ample space for checking and memoranda. The larger page taking more matter naturally requires fewer pages and gives a thinner book which in turn makes it easier to handle. The publishers statement in the front says that although the increased size of the page takes 25% more matter and would normally reduce the number of pages from 2,800 to 2,100, enough new matter has been added to make more than 2,300 pages. This well reflects the energy of the publishers in the performance of their task of securing new information and keeping the book up to date.

Its lists completely cover the electrical, engineering, machinery, building, manufacturing, chemical and similar industries. While we have not been able as yet to thoroughly check up the book we have noted a few changes which appear excellent, for example the subject of "Twist Drills" has been handling in a more comprehensive manner than we have ever noticed in any similar publication and which is new in this edition. The same is true of "Fire Doors," and "Electric Lamp Sockets."

For years we have used "Hendricks'" in our work and have found it so comprehensive without "padding," so well arranged and thoroughly indexed for instant reference that we can hardly do without it and have no hesitancy in recommending it to our subscribers as an invaluable guide in both their purchasing and selling. Price $12.50. Sent on receipt of price by S. E. Hendricks Co., 70 Fifth Ave., New York, N. Y.

New Slow Setting Cement

A new method for the production of a cement which is claimed to have substantial advantages over the forms of cement now in general use is reported to the Department of Commerce by Consul H. C. Claibourne, at Havre. The new process is stated to have been invented in 1908 by the Societe Anonyme des Chaux et Ciments de Lafarge et du Teil. The product is declared to be basically aluminous and is obtained through the melting down (in water jacket) of a specific mixture of silex, alumina, iron and lime. It is said that after much experimentation, the Societe has developed it beyond the experimental stage, and in conjunction with the Societe Electro-Chimie et Electro-Metallurgie has succeeded in the melting of cement by an electric oven process, and that these two companies are at present erecting, in the province of Savoy, a factory for the manufacture of cement under the new formula.

It is stated that the new process of cement hardens very quickly, and that within 24 hours it becomes of greater hardness than artificial cement within a period of a month. Nevertheless, the fact that it begins to set at the end of two hours and obtains remarkable initial hardness at the end of four or five hours, permits its classification as a slow-setting body. A further advantage is stated to be its immunity from decomposition on contact with sea water or sulphated waters. Likewise, the new cement, which is known as "ciment fondu" (molten cement), should be specially valuable in reinforced concrete construction, by reason of its high initial strength, which permits it to be unsheathed quickly from the surrounding supports, and permits the use of smaller frames. According to the reports of this process, the inventor and prospective manufacturers claim that it will be very serviceable in the manufacture of blocks of all kinds, more particularly for sea coast work carried on between tides, as well as for inter-linking and sealing places between disconnected bits of construction.

New Catalogs

The Sullivan Machinery Co., 418 Gas Bldg., Chicago, are mailing three new bulletins which may be of interest to our readers. They are as follows:

71-G Air Lift Pumps
71-F Displacement Pneumatic Pumps.
70-W Rotator Hammer Drills

The first and third of these are new editions of older catalogs. One of the new features in the air lift catalog is a list of instructions for customers' use in requesting estimates on air lift pumping installations.

Bulletin 71-F describes an entirely new line of pneumatic pumps, intended primarily for handling acid, but also for pumping water, or in fact any liquid when local conditions make this form of pump desirable.

Wrecking Concrete

By C. R. White

The International Agricultural Corporation, of Mulberry, Fla., control the largest phosphate fields in Florida, and their equipment runs into the millions.

They recently decided to enlarge their power plant, and in connection with this work, put down some heavy concrete foundations for boilers and a 175 ft. stack. After the concrete had been allowed to set for about four weeks, and they were getting ready to build on same, they found that the boiler foundations had soft spots in them and decided to tear out and re-build. The finding of soft spots in walls of boiler foundation made them suspicious of stack foundation, and it was also condemned.

The engineer on the job did not have much trouble in getting rid of the narrow boiler foundation walls but when it came to the stack foundation, he found that he had a different proposition.

This foundation was of solid concrete 7 ft. deep, and poured in three runs. The bottom was 22 ft. in diameter, second pouring 17½ ft., and third or top pouring 16 ft., monolithic type.

The engineer in charge at once thought of dynamite, but was afraid to trust the work of blasting out this foundation to any of the local blasters, as within fifty feet of foundation was a million dollar Diesel power plant and fifteen feet away a twenty thousand dollar Link Belt locomotive crane, which could not be moved, as well as the new boilers and their fittings scattered all around.

He asked me to take charge of this work. I was

requested to be very careful, not only to see that adjoining property was not injured, but the clay foundation must not be disturbed any more than possible by the blasting.

Holes were drilled thirty inches deep and thirty inches apart (staggered) for the first blast. This depth took holes just two inches below level of last pouring. I did this depending on the weaker stratum between pourings helping to break concrete loose at that level (2 ft. 4 in.) which it did to an inch. These holes were loaded with one stick (half a pound) of 40 per cent straight drynamite and fired electrically. I used the straight dynamite on account of its quicker action so as to get this splitting between layers and between holes.

We obtained perfect results from this shot, the concrete breaking in blocks on the 2 ft. 4 in. level and between holes and was easily lifted out with the steam hoist.

The second holes were drilled three feet apart and three feet deep (staggered). We increased the depth of these holes so as to penetrate the first layer six or eight inches, to get a shattering effect on this bottom layer to as great a depth as possible without breaking through. The blast turned out just as I counted on, breaking the second layer nicely and shattering the bottom layer to about half its depth. After broken concrete was removed, we put down just a few holes in last layer to put same in shape for handling.

Before each blast was fired, the foundation was carefully covered with heavy timbers and these anchored with railroad ties to prevent any of the blasted material from getting away. We did not throw a piece of concrete out of the pit, and everything turned out fine.

Dragline Cableway Excavators

As pioneers in designing and installing cableways for sand and gravel producers Sauerman Bros., 1139 Monadnock Bldg., Chicago, have had unlimited opportunity to perfect their ideas and the Sauerman Dragline Cableway Excavator is recognized today as the best equipment of its kind in the world.

To protect their equipment against infringement and to protect the users of their dragline cableway excavators, they have patented their different devices and special fittings. All excavators employing their patent rights must be identified by a registered number and a license plate.

New Book

Modern Building Superintendence and the Writing of Specifications. By David B. Emerson. Charles Scribner's Sons, New York, 1921. Cloth, 4×7 in., 247 pp., $1.75.

This volume is intended to aid the young engineer and contractor in superintending construction and in writing building specifications. The author outlines, step by step, the duties of the superintendent during the erection of a typical modern twenty-story office building, calling attention to the matters that must be watched. In similar fashion, he outlines the proper procedure in writing specifications for a small dwelling.

New Book

Elementary Concrete Construction
By Leon H. Baxter

The practical application of elementary work in concrete has been repeatedly demonstrated by Mr. Baxter. Under his direction the boys of the manual training department at St. Johnsbury, Vt. were engaged by the school board to do repair work during vacation, such as laying basement floors, walks, steps, setting posts and flag poles in concrete in and about the school buildings. They also did work for individuals and societies, as well as around their own homes and their work has stood the test of time.

Any book containing projects which arouses the enthusiasm of the boy, holds his interest, and inspires him to think and to do, is bound to have a wide sphere of usefulness. The price of the book is $1.25 and is published by the Bruce Publishing Co., Milwaukee, Wisconsin.

Book on Belt Conveyors

A new book on Belt Conveyors has just been published by the Link-Belt Company of Chicago, Philadephia and Indianapolis.

It is book No. 215. It fully describes the Uniroll and Multiroll Idlers recommended by this company.

Among the interesting features of the book are:

1. The correct methods of figuriny Belt Conveyors and the details entering into them.
2. Price lists which will enable the user to determine the cost of a complete conveyor or any portion of a conveyor.
3. Numerous examples suggesting the correct types of Belt Conveyors for the handling of Bituminous Coal, By-Product Coke, Sand and Gravel, Bagged Sugar or similar material, Crushed Rock, etc.
4. In addition there are many illustrations of typical installations.

This book should be a valuable addition to any library, and will be sent by the Link-Belt Company to anyone interested in this subject.

Test of a Concrete Mixer

Prof. W. K. Hatt, of Purdue University, reported at the annual meeting of the American Concrete Institute the results of a well-considered test on a standard concrete mixer which was designed to study the action of the mixer and the effect of different standards of operation on its output. The paper reports power consumption in relation to discharge and details of operation of interest to concrete users. It was found that strength and consistency increase rapidly as time of mixing is increased from 30 seconds to 1 minute, but after that any gain is hardly worth the increased cost, that the manufacturer's stated speed gave best results (in other words, that time factor rather than number of turns of the mixer is the determining factor), and that an early introduction of water to the drum brought correspondingly early strength. The paper further gives some suggestions for future conduct of such tests, which, the author states, are much needed as a step toward better concrete.

News of the Cement Mills

An exhaustive probe into the controversy over railroad rates for shipments of cement from the Kansas cement belt district into Nebraska was begun last week by the interstate commerce commission in session at the federal building, Kansas City, Mo.

The hearing, conducted by Alexander Wagner, federal examiner, follows an action brought by the Iola Cement association, with operators of numerous cement mills in Kansas as interveners.

The association charges that exorbitant freight rates are charged for shipments of Kansas cement into Nebraska and its trade territory, and that discrimination has been shown in the rates for shipments from other sections of the country.

The question of rail rates will be gone into fully in the hearing, which possibly will require two days.

Cement associations and the railroads are represented and announce that all available evidence to support their contentions will be laid before the commission.

A decision in the litigation involving the title to the property purchased several years ago as the site for the Red Star Cement Company (Fritz Worm, former president German American Portland Cement Co., is president) is expected to be handed down in the Illinois Supreme court this month.

The hearing involved the possession of limestone rights in 195 acres of farm land, valued at between $500,000 and $600,000, along the Vermillion river in La Salle, Ill. The contest is being made by the La Salle County Carbon Coal Company and the Matthiessen & Hegeler Zinc Co., both of La Salle, who have a deed to the coal and mineral rights under the surface of the land, and Joseph H. Kinder and brothers, as owners of the surface of the land in question.

The Kinder brothers claim the limestone rights on the ground that some of the limestone crops out of the surface on the part of the land which is on the banks of the Little Vermillion.

Without the limestone rights, the land would be useless for cement manufacturing purposes; hence the Kinders are anxious to retain the limestone rights to justify their sale to the Red Star plant.

After the hearing on the arguments the court took the case under advisement. It is expected that they will render a decision at the December term.

J. H. Eschen, 1858 Washington ave., Northampton, Pa., who has had over twenty years experience in both wet and dry process cement mills as chief chemist and superintendent has recently returned to this country from Singapore, Malaya, where a new plant has been erected and is in running order.

The Lehigh Portland cement mills at Mitchell, Ind., with a daily capacity of 125 carloads of cement, closed down Dec. 1, indefinitely, throwing 600 men out of work.

Double wall concrete houses with a dead air space have been built economically by the Nebraska Cement Company of Superior, Neb., using Frost's wall forms made by the Hollow Concrete Wall Co., Mitchell, S. D. The cement company constructed sixty houses and a three-story hotel for their employees.

After a thorough investigation of different hollow wall systems the Nebraska Cement Company decided on using the forms made by the Frost Hollow Concrete Wall Company. Mr. W. T. Groner, superintendent, Nebraska Cement Co., writes as follows:

"Regardin goperations of forms, will say that we are well satisfied and do not believe there is anything on the market that could equal same for our requirements. They fulfill every claim you make for them regarding simplicity and economy of operation."

C. L. Carman, 6 Eagle St., Scotia, N. Y., is now open for engagement in the cement field as designing engineer for a new organization, as chief engineer, or manager for any good cement company now operating. If there is any cement company desiring to strengthen their organization they should get in touch with Mr. Carman as he is an engineer of long experience in the design and operation of portland cement plants and in the design of crusing and grinding machinery.

A reinforced-concrete tower was recently built in the center of the clinker storage yard of the Riverside Portland Cement Co., near Riverside, Cal., to support a cantilever crane which is used to pile clinker or to deliver it to a continuous belt conveyor. The crane proper is built of structural steel, but the tower was made of concrete because concrete was cheaper, would be effected less by hot clinker piled around it and would require less maintenance.

The tower is circular in section, 55 ft. high, and has an inside diameter of 30 ft. The walls are 2 ft. in thickness except at the parapet where the thickness increases to 3 ft. The foundation extends 4½ ft. below the ground level and has a diameter 4 ft. greater than the superstructure. A 6-in. diaphragm of floor supported on beams is located 7 ft. below the top of the tower.

The revolving element which weighs 140 tons, is supported on a track laid on ties placed radially around the parapet. The two crane arms are each 110 ft. long and operate 50-cu.ft. grab buckets. When operating both buckets, the capacity of the crane is 6,000 bbl. per 10-hr. shift. The seven motors on the crane, ranging in capacity up to 40 hp., are said to cause no vibration.

This week, from day to day, the different departments of the Alpha cement plant are being closed for an indefinite period. The plant has run very steadily

and successfully this season and generally there has been work for all applicants.

Already the transient laborers are leaving town and others are adjusting themselves for winter as well as they are able.

It is understood that the shutdown will be nearly complete and that the usual winter work of repairs will not be begun at present.

Messrs. O. J. Binford and M. Hoffmann, representing the Southwestern Portland Cement company, El Paso, Texas, were in Waco, Texas, last month looking over the large tract of limestone land recently purchased by them. The company purchased the land for the purpose of utilizing it for a big cement plant to cost perhaps $3,000,000, and Messrs. Binford and Hoffmann were in Waco to examnie the tract with a view of deciding upon the site for the plant to be constructed thereon when the company decides to begin work. More than $51,000 was paid for the land and the expressed purpose of the company is to establish an up-to-date cement plant to use the material that abounds on the land.

E. M. Confer has resigned as superintendent of the Gulf States Portland Cement Co., Demopolis, Ala., to accept a position of general manager of the Calera Development Co., Eureka, Ala., which manufactures hydrated lime and crushed stone.

L. I. Loghry recently received appointment of chief chemist for the Knickerbocker Portland Cement Co., Hudson, N. Y.

The Dewey Portland Cement Co., Mutual Bldg., Kansas City, Mo., has let the contract to McDonald Engineering Co., Monadnock Bldg., Chicago, for the construction of four concrete storage tanks, having a capacity of 20,000 bbls. Cost $60,000.

New teeth were put on a gear in a certain cement mill recently and the gear was put back into service immediately. When the five teeth were broken off, this gear was scheduled for the scrap heap and a new one was to be purchased. One and a half hours later it was cooling off with a deposit of new metal completely filling the broken part, and allowing a short time for machining, it was ready for service. Cases such as this are common with arc welding—the modern repair process. Gears, pinions, shafts, metal plates and castings are no longer banished to the scrap heap when broken or worn—they are repaired or rebuilt and made to serve anew. The entire cost of an arc welding set is insignificant when compared with the service it will render the cement mill to keep its machinery repaired economically. It will save its cost in a matter of a few months. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., have a bulletin No. 7149 and leaflet 1825 concerning arc welders which contain valuable data for your repair equipment files. Write them for copy.

A rate of 34 cents per 100 pounds on cement, carloads, from Manchester, Houston, Hays and Earle Ford to Eagle Pass, Texas, and intermediate points between Spofford and Eagle Pass, has been authorized by the Texas railroad commission on the application of the Texas lines.

The plant of the Lehigh Portland Cement Co., at Iola, Kans., which has been closed down since last August, will resume operations Jan. 1st. During the time the plant was closed down important construction work, alterations and repairs were made and everything about the mill is now in tip-top condition. About 100 men were kept busy making the repairs.

Paul P. Kaylor, electrical engineer of the Olympic Portland Cement Co., Bellingham, Wash., recently gave a short but interesting talk on the operating plan of the plant. The mill is capable of crushing eight 50-ton carloads of limestone per day, 1800 barrels representing the plants capacity. The merits of "Cal," as a cement hardening accelerator, were discussed. The talk yas given before the Bellingham chapter of the American Association of Engineers.

The Sandusky Portland Cement company's plant, at Syracuse, Ind., which formerly employed several hundred men, but which has been idle for a long period, never will resume operations, according to press reports.

The suspension of the plant was due to the fact that the process of manufacturing cement from limestons is much cheaper than producing it from marl, found here in large quantities. There are limestone deposits here, but engineers who have made an investigation hold that it will not pay to bring the rock to the suface.

O. E. Wasson, formerly general superintendent of the Knickerbocker Cement Co., Hudson, N. Y., has accepted a position with the Crescent Portland Cement Co., Wampum, Pa.

The new English book, *Cement,* by Bertram Blount, assisted by W. H. Woodcock and H. J. Gillett, is reviewed by S. G. S. Panisset in *British Chemical Industry* as follows:

This is a welcome addition to what may be described as the "popular" literature on cement. The author has to a large extent kept to the beaten track, which has led to similar books being stereotyped and uninteresting, but he has interspersed the inevitable historical quotations, descriptions of cement-making machinery, and extracts from standard specifications, with items of personal experience and predictions of the future trend of the industry that render the work under review of considerable interest and worth the while of even a cement manufacturer to read.

In the opinion of the author, the portland cement industry will develop on the lines of blast-furnace practice for burning, either by electrical heating or with oxygen-enriched air as a means of attaining the high temperature required, together with some undefined method of destroying the quality of toughness in the resultant clinker, and so enabling it to be ground with a fraction of the power now absorbed.

There is indeed much in the book that should cause the cement manufacturer of today to think, and it will be interesting to observe whether, with this suggestive work before him, the British cement maker will take the lead or will again be satisfied for other countries to be the pioneers.

It must be admitted that the British standard specification for portland cement in limiting the molecular ratio of lime to silica and alumina does not encourage progressiveness, and the first manufacturer to produce the fused clinker containing 70 per cent of lime, stipulated by the author, would probably be unable to market his cement as complying with the specification. [Sent on receipt of price ($5.00) by Longmans, Green & Co., 4th Ave. & 30th St., New York, N. Y.]

News of the Concrete Products Factories

The Art Concrete Works, Pasadena, Calif., own patents on various products including a portable knock down type of concrete wood park bench and they are now selling molds to anyone for making this bench, the concrete supports of which are made of 1:3 concrete; properly cured and properly finished. The seat and back slats of the bench are of wood, passing through mortices in the concrete supports. Wedges hold the entire seat together until such time as it is desired to remove the bench when the wedges can be driven out, the slats removed and the entire seat knocked down.

"There are two ways to make building, drain and silo tile. Buy three different machines or install a Dunn tile machine. Dunn Tile machines are not limited to the making of one product—they make three of the best sellers in the concrete products field. There's a bigger demand for Dunn Hollow Building Tile than for the common block and brick because it builds a dry wall and is by far the most economical building unit. It's more than a cellar block; it's a wall tile. Dunn Drain Tile have long been recognized as the best drain tile made. There are millions of them in use today. And the hollow Interlocking Silo Tile has made silo building easy and inexpensive because no mortar is required.

"The Dunn Automatic will turn out 3,000 products daily. The smaller Dunn Junior has a daily production of 1,500 units. No pallets are used with either machine.

"Is it good business to operate machines that make products of limited usefulness when a Dunn Tile machine will turn out for you such a diversified line of marketable products in large quantities at a surprisingly low cost.

"We're prepared to furnish you with an individual Dunn Tile machine or to set you up in business with a completely equipped standardized products plant," writes the W. E. Dunn Mfg. Co., 414 W. 24th street, Holland, Mich.

Helm Brick Machine Co., 764 Mitchell St., Cadillac, Mich., attaches to all the machinery it ships a linen tag on the back of which is printed this caution: "In operating your Helm equipment do not forget that concrete block, brick and tile used in house construction should meet the requirements of the standard specifications and building regulations adopted by the American Concrete Institute and as they may be amended from time to time. Refer to our operating instructions where you will find American Concrete Institute standard No. 10 quoted." This is a step in the right direction and one which should be followed by every manufacturer of concrete products machinery.

The Mid-West Concrete Producers Association, Frank Whipperman, Secy., Omaha, Nebr., have decided to hold their annual building show and convention at the Auditorium, Omaha, Nebr., January 23-28, inclusive.

Concrete block manufacturers of Flint, Mich., met recently and decided to organize a Flint Cement Block Manufacturers' Association. The purpose of the association will be to devise ways and means to conform with the ordinance recently passed by the common council and it will start out with about fifteen members.

In order that none but established, recognized manufacturers be allowed to operate in the city it is proposed that they be required to take out a bond or license from the city. In this way the city government would have a substantial means of control and reputable manufacturers would be protected. Inspector Willard O. Kirkpatrick, of the city building bureau, is going to Detroit to study the workings of that city's building inspection departments as regards the manufacture of cement blocks.

In considering the possible development of Institute work in the field of factory-made products, it was felt that the very limited number of committees working in this field, did not fairly represent the importance of that branch of concreting as compared with other lines, and that in this field also there was a special opportunity to be of service in developing higher standards, says a recent announcement of the American Concrete Institute, 314 New Telegraph Bldg., Detroit. At the same time, Institute membership from among products manufacturers is comparatively small, insufficient probably for a nucleus of as many technical committees as the work of the field demands (although many new products members have recently been added). A good many concrete products manufacturers have identified themselves chiefly with the producer organizations representing special branches of manufacture, therefore in enlarging its program in the products field, it will be the policy of the Institute to bring the best element among products manufacturers together with representatives of users of their products and with technical men in the concrete field generally, so that the recognition of products manufacturing standards may be more prompt and general through the confidence inspired in a technical organization like the Institute, combining the knowledge of both user and producer for the best interests of the public. It is proposed to extend the Institute program in the produce field as rapidly as an increasing membership warrants it. The former committee of the Institute on Concrete Products Manufacture was retired and new committees for immediate work in that field organized as follows:

P-1 Standard Building Units

(Including Block Brick and Structural Tile)

It is the work of this committee to develop specifications and manufacturing practice with a membership consisting of producers of standard units, architects and others making extensive use of them. The Committee is at work on recommended practice to be used by manufacturers of standard units, and on specifications to be used by architects and engineers in applying them to building construction. Membership on this committee as appointed by the Board of Direction is as follows:

Chairman, R. F. Havlik, Mooseheart, Ill.; Secretary, W. R. Harris, 5235 Cornell Ave., Chicago, Ill.; George Barriball, Newton D. Benson, W. H. Carey, Austin Crabbs, J. K. Harridge, H. K. Holsman, F. J. Kinzinger, C. E. Lindsley, Edward Probst, George H. Schwan, Charles A. Steward, Stanton Walker, S. H. Wightman, H. G. Davis.

You can use the new low-freezing DU PONT STRAIGHT DYNAMITE in any weather without thawing

"This powder gave us excellent results.....as we found it was the only powder we had during the past winter, and especially during zero weather, which we did not have to thaw, it being in perfect condition at all times when we took it out of our large unheated magazine .....this is the type of powder we have long looked for."

(Excerpt from letter from a large user of explosives)

THE quick action, great shattering power and reliability of Du Pont Straight Dynamite has made it for many years the standard for many kinds of work. The new low-freezing Du Pont Straight, the result of years of work by Du Pont Chemical Engineers, retains all the finer qualities of the old "Straight" without its great disadvantage—high freezing point, requiring a time-wasting and dangerous thawing operation. The new Du Pont Straight can be used successfully without thawing in any weather. It is indeed "the type of powder we have long looked for."

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

Branch Offices:

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Huntington, W. Va.
Kansas City, Mo.
New York, N. Y.
Pittsburgh, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
Springfield, Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

THE SCOOP CONVEYOR

THOUSANDS IN USE

FOR STORING AND RECLAIMING
LOADING AND UNLOADING
CARS, TRUCKS AND WAGONS

SAVES 6 TO 12 MEN
SAVES CAR DEMURRAGE

ELIMINATES SHOVEL AND WHEELBARROW WORK
KEEPS EQUIPMENT MOVING

WRITE FOR CATALOGUE

PORTABLE MACHINERY CO., PASSAIC N.J.

SELECTED WHITE SAND

UNEXCELLED FOR

Facing Concrete Blocks, Ornamental Concrete Stone, Hard Plaster, Finishing, Exterior Plastering, Roofing, Stone and Marble Sawing, etc.

Prices, Freight Rates and Samples on Application
Shipped in Paper Lined Box Cars
Small Shipments in 175-lb. Bags

Ottawa Silica Company
OTTAWA, ILLINOIS

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

Announcement To Concrete Products Men

The Kent Machine Co. is now placing on the market the following machines to be known as the

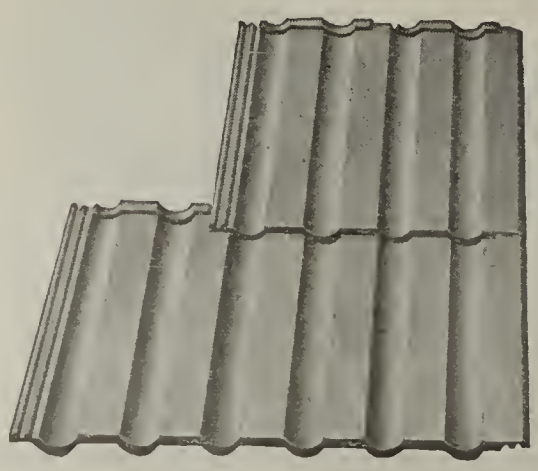
Red Line Products

Post Economy Punch	Continuous Mixers
Automatic Tampers	Batch Mixers
Block Machines	Elevating Devices
Block Cars	Lift Trucks
Electric Motors	Gas Engines

The usual excellent Kent Standard will be maintained.

THE KENT MACHINE CO.
KENT - - OHIO

THE UNITED STATES CHAMPION CONCRETE ROOF TILES



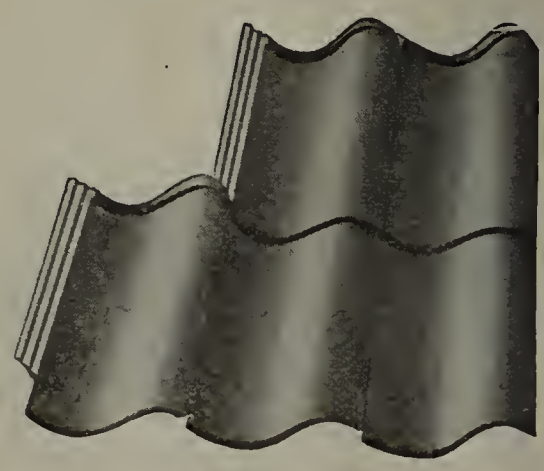
FRENCH TILE

Is a perfect and durable roofing. They firmly interlock and overlap one another in both ends and sides of the tile. A peculiar feature of our tiles only. They are carefully designed in a variety so complete that any roof can be finished beautifully with them. No matter how complicated it is.

For nearly 30 years our tile machinery has been in successful use. Its simplicity, lasting quality and unequaled capacity have created a very great demand for it everywhere when introduced.

Buy the U. S. Champion Tile Machines for making French and Spanish Tile. Their moderate price and superiority to any others will justify your purchase of them. Write us for description and prices.

L. HANSEN CO.
3617 East 23rd St.
Kansas City, Mo.



SPANISH TILE

Automatic Sealing Vaults

The concrete burial vault business is good RIGHT NOW

Can you imagine what effect a period of building depression has upon the business of manufacturing and selling burial vaults?

It has absolutely no effect.

The demand for burial vaults of all kinds is governed by the law of mortality which no man can change. It is absolutely constant.

The demand for concrete burial vaults is steadily increasing due to the growing appreciation of a permanent vault in the minds of the general public.

Upon such a solid basis of continued demand, is the prosperity of the burial vault business founded.

Any man with a concrete plant or with concrete experience or with concrete equipment or all three will find upon even the most casual investigation that the manufacture and sale of concrete burial vaults, if they are of the right type, present an unusual opportunity for founding a business that is not subject to fluctuating market, a business which changes steadily only in one direction, that is up.

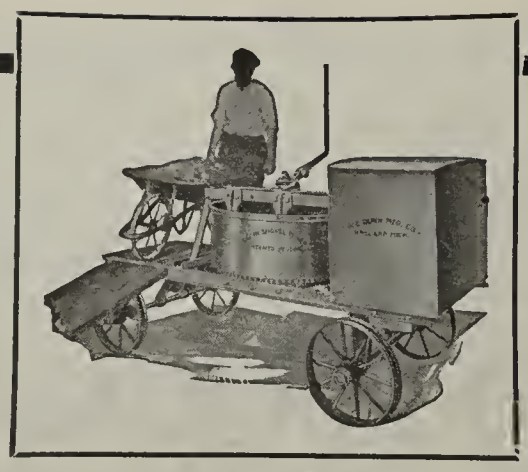
It takes a little money to establish the business, it requires very little floor space, a minimum of equipment and involves no special labor problems. It is in no sense a seasonal business as the demand in one month is just as great as the demand in any other month, depending of course upon the mortality rate.

The manufacturing process is simple, the selling plan easy.

Every burial vault factory that was founded right is prospering today. It is prospering at a time when a good many other concrete men find themselves without a business. Isn't now a good time to investigate it?

AUTOMATIC SEALING VAULT CO.

216 East River Street, Peru, Ind.



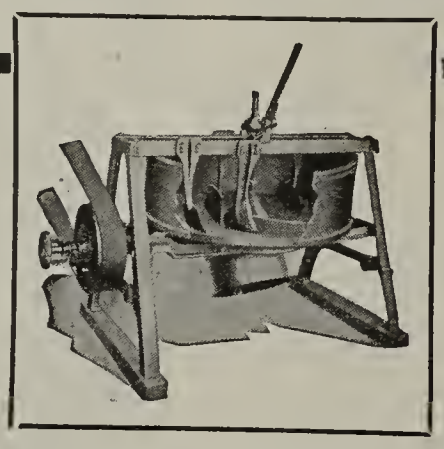
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



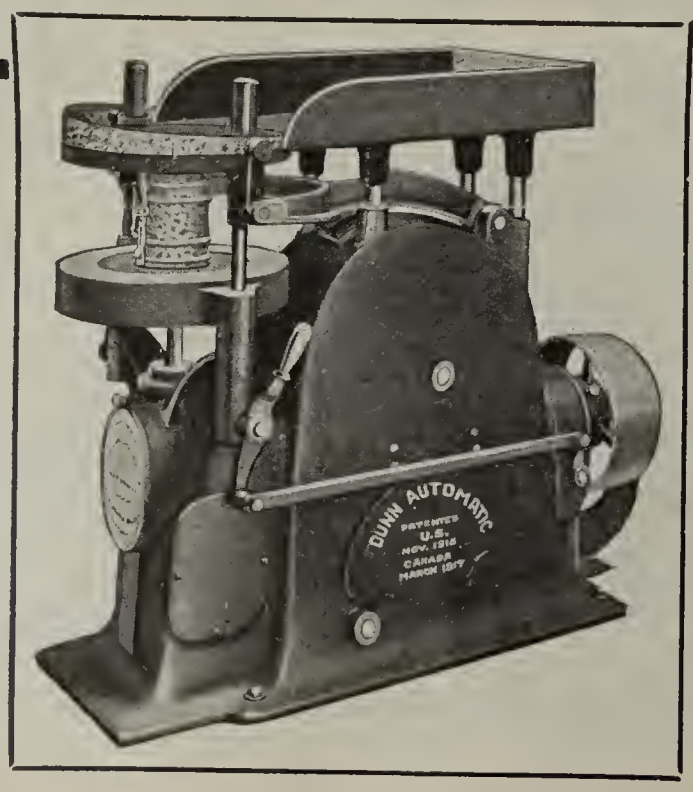
The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

414 W. 24th Street

HOLLAND, MICHIGAN

A BRIGHT FUTURE LOOMS UP FOR THE BUILDING INDUSTRY IN 1922

ARRANGE TODAY TO GET YOUR

HELM BRICK AND BLOCK PRESS

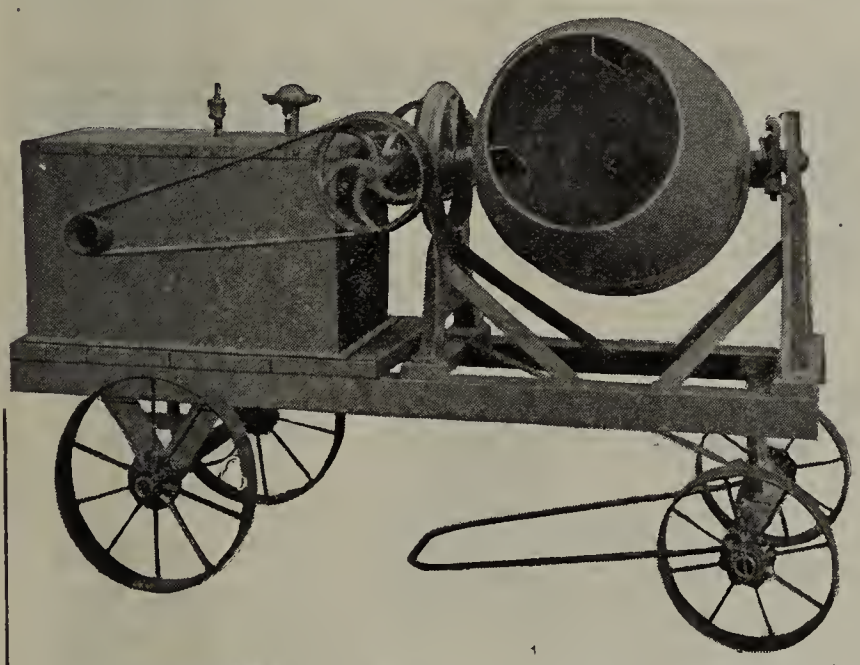
Bricks and blocks produced on a HELM PRESS are the finest looking and the most permanent, because the machine comes down with a pressure of 40 tons on the medium wet concrete, which welds all the elements of these materials so as to be able to resist fire, moisture, wear and tear.

Another reason why you should buy a Helm Machine is that your production is unlimited—you can turn out 15,000 brick or 1,500 24″ blocks in a day if you wish.

And finally, the Helm Press is built to last—to produce for you year after year without complaint, without repairs.

Write for free book on Successful Brick and Block Making.

THE HELM BRICK MACHINE CO.
860 MITCHELL ST. CADILLAC, MICH.



Biggest Mixer Bargain Ever Offered

REMMEL MIXRITE Concrete Mixer

The World's Best 4 Cubic Foot Mixer

All Iron and Steel construction, with the EXCLUSIVE SIDE GEAR DRIVE, that adds 100% to its worth. Mixer loads or discharges from either side—always in gear when dumping. Strongly built—no wobbling.

The Popular Mixer for

MASON CONTRACTORS
Saves 50% in Labor

CONCRETE CONTRACTORS
Large enough for the average job and small enough to be readily moved. A Money Saver.

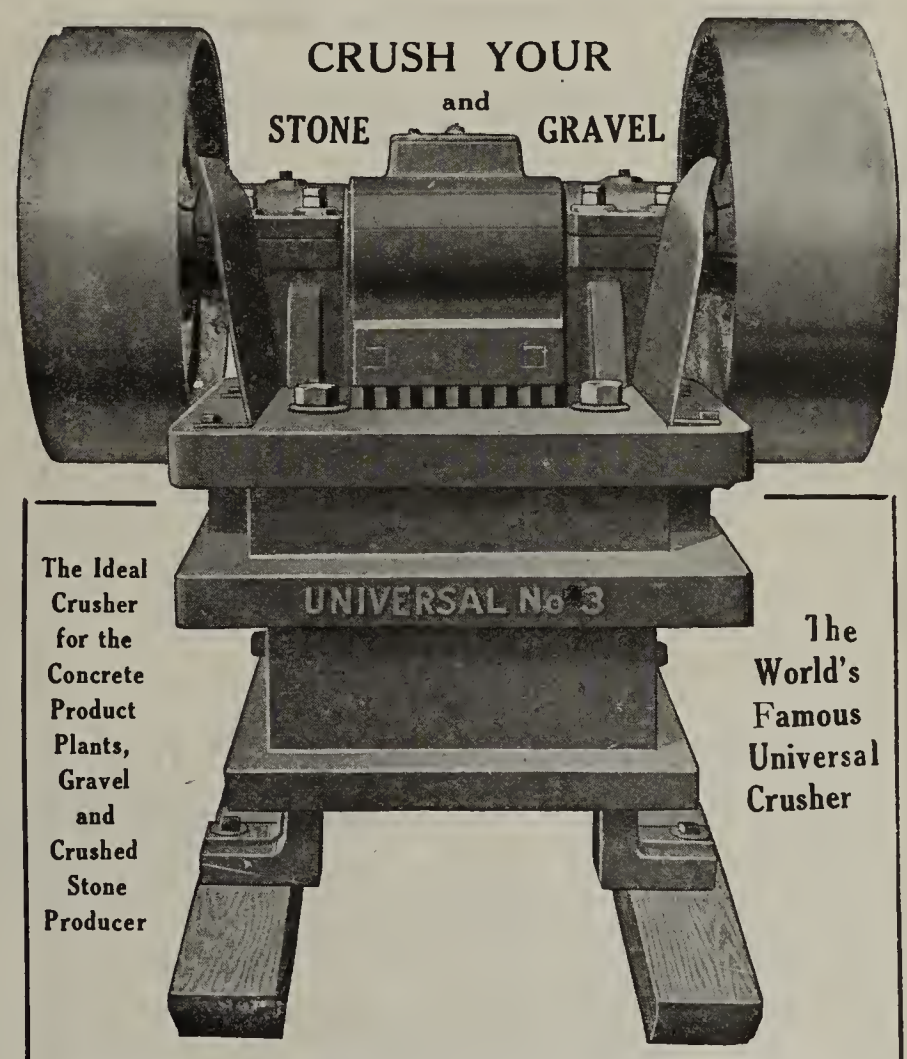
CARPENTER CONTRACTORS
Just the right size for foundations and floors.

TOWNSHIPS
Just right for culvert and county work.

Sold Under Iron-Clad Guarantee. Write for complete specifications and descriptive circulars. Dealers wanted everywhere.

REMMEL MANUFACTURING CO.
Dept. E Kewaskum, Wis.

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY
230 Bee Ave. Cedar Rapids, Iowa, U. S. A.

THE POLK SYSTEM

All-Steel Machines for All Kinds of

Circular Concrete Construction

We contract grain storages.

Polk Genung Polk Company

521 Occidental Bldg.
Indianapolis, Ind.

Fort Branch,
INDIANA

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
supplying cement works with

Chemical Apparatus, Chemicals and Reagents

Gilmore's Needles, Cement Moulds, Vicat Apparatus,
Schumann's, LeChatelier's and Jackson's
Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters

High Grade Goods Only

Satisfaction Guaranteed

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

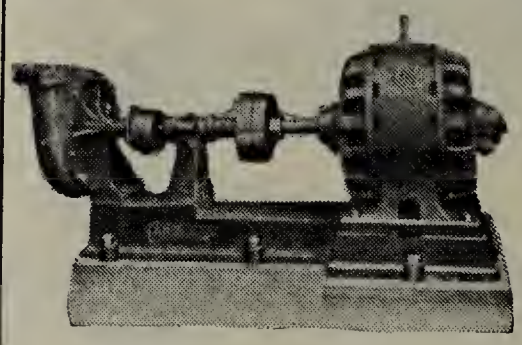
Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

AMERICAN

TRADE MARK REG'D. U.S. PAT. OFFICE

PUMPS



Built to Meet All Possible Power Plant Requirements

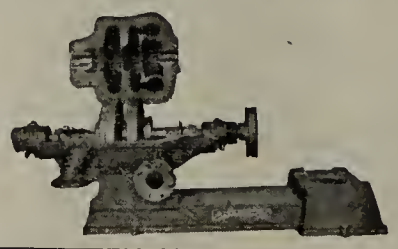
Fifty standard types of centrifugal pumps regularly built and special designs as wanted.

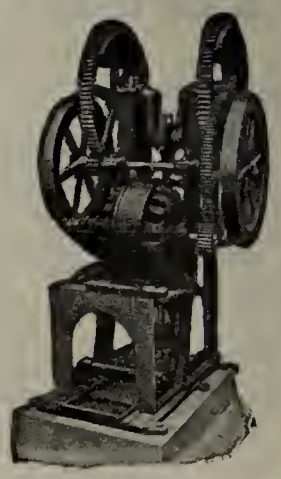
Also a complete line of deep well plunger pumps.

Write for Catalogs.

The American Well Works

General Offices and Works: Aurora, Ill.
Chicago Office: First National Bank Bldg.





SAND PUMPS

That pay the largest dividends per dollar of investment.

"The Pump That Makes The Money."

This Pump is all that is implied in the name

LIGHTNING

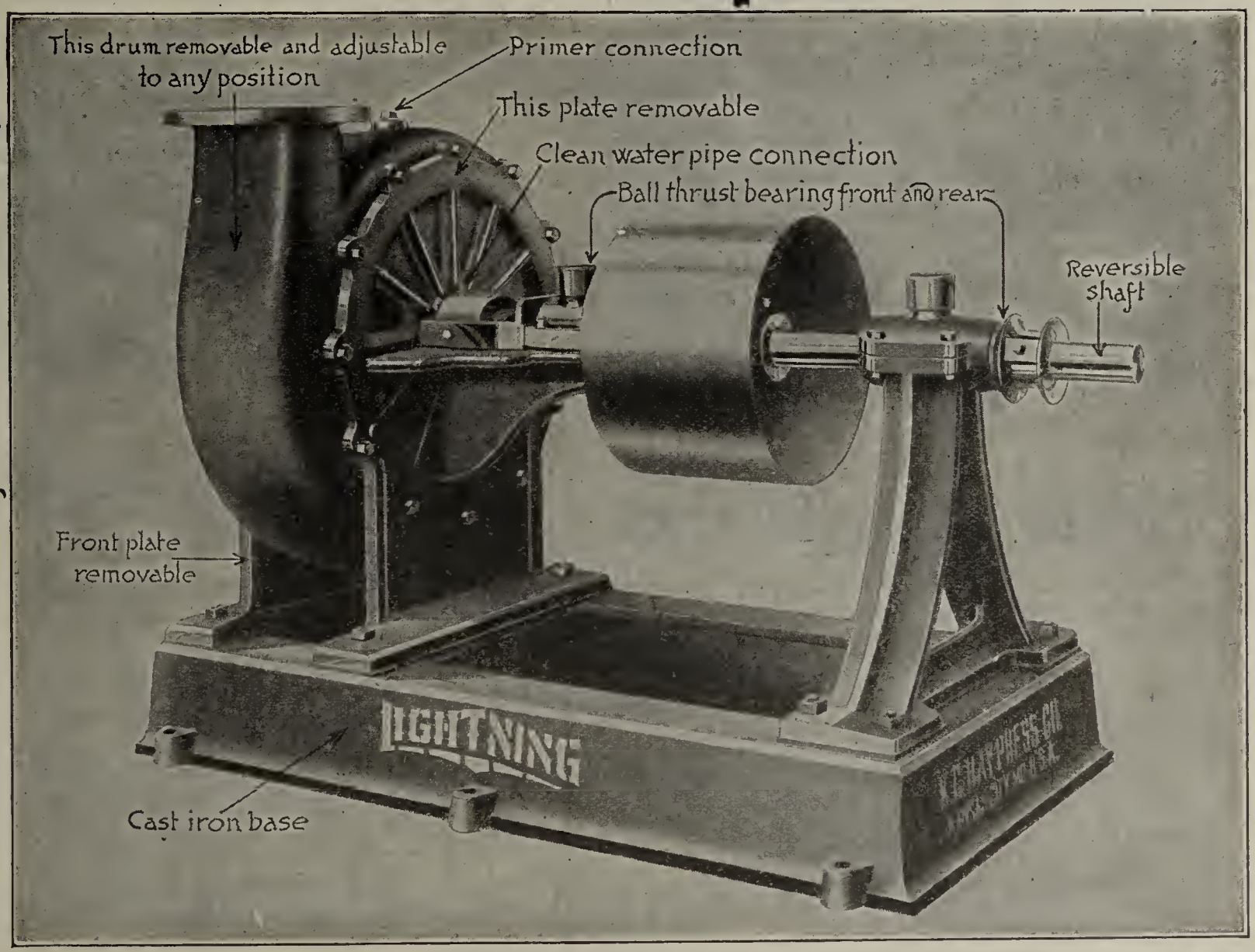
Its rugged construction and Simple operation assures maximum efficiency in operation at all times.

It is easy to adjust and easy to replace parts. Thousands in successful operation are striking endorsement of their dependability.

KANSAS CITY HAY PRESS & TRACTOR COMPANY

KANSAS CITY, MISSOURI

THE PUMP OF SIMPLICITY AND STRENGTH



The Modern Way To Dig and Convey Gravel

Evidence is available to warrant the statement that a Sauerman Dragline Cableway Excavator can dig and deliver to the hopper of a washing and screening plant, any definite tonnage of sand and gravel at a lower per ton cost than is possible with other equipment or combination of equipment.

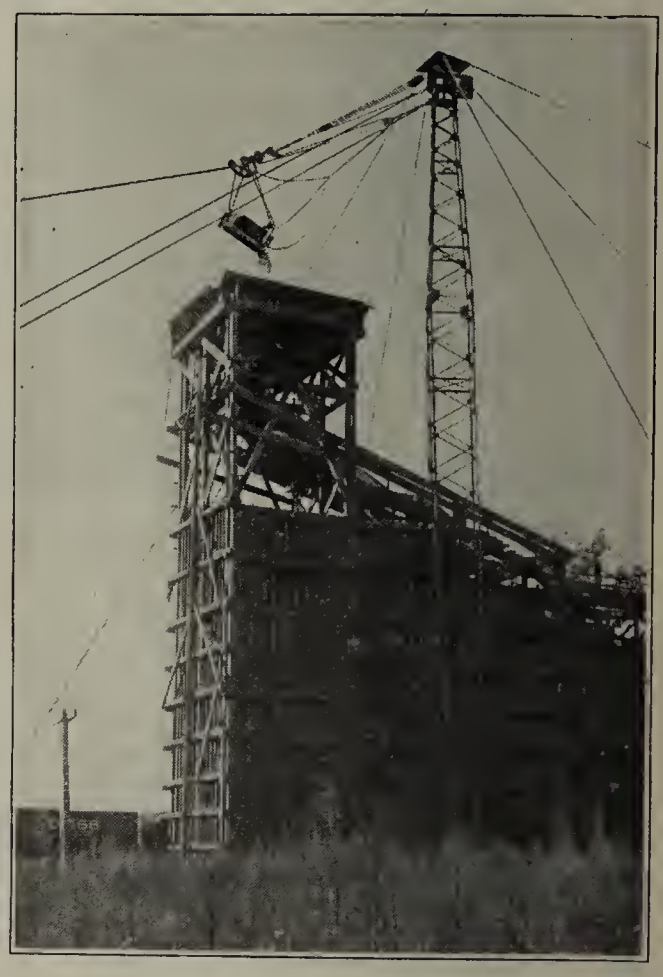
The cost data forming the basis of our claim has been supplied by prominent gravel producers who have operated Sauerman Dragline Cableway excavators for a considerable length of time. Some of these producers employ several of our equipments at different locations with consequent variations in ground conditions and none of the cableways has been favored by especially ideal digging conditions.

If you are figuring on developing a gravel proposition, you too, will find it to your advantage to ask our engineers to submit their recommendations.

Write for Bulletin No. 14

Sauerman Bros.

1139 Monadnock Bldg., Chicago



Sauerman Dragline Cableway Excavators

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

POWER DRAG SCRAPER

The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN

907 Lumber Exchange Bldg. Chicago

ON OCEAN FRONT FIREPROOF

The Breakers

ATLANTIC CITY, N. J.

Unusually attractive during Autumn and Winter Seasons.

RATES GREATLY REDUCED.

Luxurious, heated Solarium, bathed in Sunshine, overlooking the ocean, where charming afternoon musicales and complimentary "Five O'clock" Tea Service invites complete relaxation after your return from an outing on the exhilarating Boardwalk, or from the Golf Course.

AMERICAN AND EUROPEAN PLANS.

NEW GOLF CLUB PRIVILEGES FIREPROOF GARAGE

Cement and Engineering News

Vol. 34 Chicago, February, 1922 No. 2

Surface Treatment of Concrete

Three years' exposure has brought out no defects in the surface finish on the concrete piers and hand rail of the Bloor St. viaduct, at Toronto, according to a paper presented Feb. 17 before the Toronto Branch of the Engineering Institute of Canada, by T. Truman Black, Construction Engineer, Toronto. Mr. Black gives the following details regarding the surface treatment methods:

On the piers as soon as the forms were removed the surface was smoothed up, either by wooden trowel if the concrete were still soft, or by carborundum brick if the concrete were hard. The surface was then thoroughly washed with a hose. While wet the surface was floated with mortar with a wooden trowel and left for a short time; then another man followed with a steel trowel and scraped all the mortar possible from the surface. This left the concrete surface clear of mortar, while the small holes were filled. The surface was then gone over with a white-wash brush dipped in a wash of cement and water, and a clean waterproof surface was the result. After three years this surface is free from hair cracks or other defects.

In the hand rail the conditions were different. The specifications stated that the surface should be so treated that the larger aggregate should be exposed but not disturbed. This aggregate was 1-in. red granite. This result was obtained by the following means:

The forms were so built that a small part could be removed at a time. The time for removal was chosen when the concrete had to some extent taken its final set, though still very fragile. A small portion of the form was removed the mass of the hand rail being supported by the remainder of the form. A laborer with a wire brush immediately went over the surface and brushed out the surface mortar for about ¼-in. from between the stones. If the concrete were soft, a fine brush would do the work; and as the concrete got harder, stiffer brushes were used. The action of the brushing seemed to speed up the setting, and the surface was much harder when the brushing was completed, though it had taken only a few minutes. The whole surface was treated in this manner. After all the surface had been stripped and brushed, men went over it again with water and scrubbing brushes. This removed part of the gray mortar which was sticking to the exposed granite. About six hours later the entire surface was washed with a dilute solution of muriatic acid, which removed all the cement from the exposed granite and left the surface clean. After the acid bath the surface was flushed with water until all the acid was washed away.

In the surfacing of the railing it was noticed that the brushing made the surface concrete much harder than that which was allowed to take its usual time in the forms—a sort of case hardening. After three years the railing does not show any defects, and boys have not been able to pry any of the exposed granite from the surface.

Surfacing Concrete Blocks

White cement for both white and colored finish of concrete building blocks was recommended at the recent annual meeting of the Concrete Products Association, at Chicago, by Gale M. Brooks, engineer of the technical-department of the Atlas Portland Cement Co. An abstract of his paper is given below:

A white mortar facing made with white sand or marble dust in which 1/16-in. particles predominate will make a good surface which is an integral part of the block. This facing need be only ½-in. thick and can be used with little additional labor in manufacture. With a 1:3 mix of white cement and white sand, the body of the block can be made with a leaner mix and larger aggregate than would be used otherwise. Colored sands may be used, or mica spar mixed with the white cement and white sand to give a surface lightly flecked with black. Brownish yellow sands with the white cement give various shades of buff. A little selection of sand will permit the matching exactly of any desired natural stone color.

Further variety of surface can be secured by the use of color aggregates with the white cement mortar, such as one part white cement, 1½ parts white sand and 1½ parts of 1/16- to ¼-in. granite or marble chips. The thin film of cement on the surface when the block comes from the form can be removed with a very fine spray of clear water if the forms are removed early. If the blocks are allowed to harden more thoroughly before being released from the forms, this film can be removed by washing the surface with 1 to 3 diluted muriatic acid or by rubbing with a carborundum block. A power polishing machine may be used where a smooth surface is desired.

In place of the white sand, marble dust can be used in conjunction with the coarse color aggregate, but the dust should have a large percentage of coarse particles, 1/32- to 1/16-in. The dust of pink granite mixed with the ¼-in. chips and white cement gives a good surface. Delicate color tints can be secured by the use of numeral pigments with white cement, but too much pigment weakens the stone and increases the chance of fading and of uneven distribution in the mixture.

One-Course vs. Two-Course

Tendency Toward Simpler Construction of Concrete Sidewalks

Custom and habit are among the strongest influences in determining construction methods. Tried and true methods are slow of change.

Contractors who advocate the single course type of sidewalk contend that only custom and habit can account for the continued building of the older type of two-course walk. As soon as owners and builders become accustomed to the single-course walk it will displace the two-course.

In the first place, the single-course walk is much more convenient to lay, because only one mixture is employed, instead of the concrete mixture and the mortar mixture necessary in two-course work. By finishing with a wood float the one-course walk has a slightly gritty surface which affords safer foothold than the highly polished and "slick" surface of two-course walks.

In addition to these advantages, there is a slight saving in the amount of cement necessary. The following table gives figures for both types of walk:

Take for example two 5-in. thick walks; one a single-course of 1:2:3 mix and the other a two-course walk with a 4-in. base of 1:2½:5 mix and top-course 1 in. of 1:1½ mix.

We find that for 100 sq. ft. the single course requires 2.68 bbls. of cement while the two-course calls for 2.71 bbls. of cement. The saving in material is not great, but the saving in cost of laying the walk will be found well worth while.

Of course, there will always be some persons who prefer the more highly finished 2-course walk, but it is safe to predict that the single-course will constantly gain new adherents.

*QUANTITIES FOR ONE-COURSE SIDEWALKS AND FLOORS
100 Square Feet of Surface

Thickness, Inches	Cubic Yards of Concrete per 100 sq. ft.	1:2:3 Mix			1:2:4 Mix		
		Cement bbls.	Sand Cu. Yds.	Stone Cu. Yds.	Cement bbls.	Sand Cu. Yds.	Stone Cu. Yds.
3	0.93	1.62	0.48	0.72	1.41	0.42	0.83
3½	1.08	1.88	0.56	0.83	1.63	0.49	0.96
4	1.22	2.14	0.63	0.94	1.84	0.55	1.09
4½	1.39	2.42	0.72	1.07	2.10	0.62	1.23
5	1.54	2.68	0.80	1.18	2.33	0.69	1.37
5½	1.70	2.96	0.88	1.31	2.56	0.76	1.51
6	1.85	3.22	0.96	1.42	2.79	0.83	1.64

*QUANTITIES FOR TWO-COURSE SIDEWALKS AND FLOORS
100 Square Feet of Surface

Thickness, Inches	Base Course					
	1:2½:5 Mix			1:3:6 Mix		
	Cement Bbls.	Sand Cu. Yds.	Stone Cu. Yds.	Cement Bbls.	Sand Cu. Yds.	Stone Cu. Yds.
3	1.15	0.43	0.85	0.98	0.43	0.87
3½	1.34	0.50	0.99	1.15	0.51	1.02
4	1.51	0.56	1.12	1.29	0.56	1.12
4½	1.72	0.64	1.28	1.47	0.65	1.31
5	1.91	0.71	1.42	1.63	0.72	1.44

Thickness, Inches	Top Course					
	1:1 Mix		1:1½ Mix		1:2 Mix	
	Cement Bbls.	Sand Cu. Yds.	Cement Bbls.	Sand Cu. Yds.	Cement Bbls.	Sand Cu. Yds.
½	0.75	0.11	0.60	0.13	0.50	0.15
¾	1.13	0.17	0.90	0.20	0.75	0.22
1	1.50	0.22	1.20	0.27	1.00	0.29

*The quantities given in this table are based on exact thicknesses and with no allowance for waste. Variations and inaccuracies in the subgrade may cause quantities to differ from the figures given in this table.

Effect of Colorings on Concrete Strength Determined by Test

Discussing the paper on "Coloring Concrete" by John W. Lowell, before the recent annual meeting of the American Concrete Institute, Prof. Duff A. Abrams, of Lewis Institute, Chicago, gave the following report of some tests on the effect of these coloring agents on the strength of concrete.

The accompanying table gives the averages of the compressive strengths of 3x6-in. cylinders, made of 1:2 mortar and tested at ages of 7 to 28 days. Portland cement was used; the aggregate was a coarse sand from Elgin, Ill. The percentages of coloring materials are in terms of the weight of the cement. Each value is the average of three tests made from a single batch of concrete. The tests on each color were made at different times; this accounts for the three values given in the third column for the mortars without coloring.

Coloring Material—	Age at Test Days	Compressive Strength of Mortar Mixed with Different Percentages of Color, Lbs. per Sq. In. None	0.5	2	5	10	15
French's C. U. Blue	7	2,100	....	2,500	2,960	3,210	3,720
French's C. U. Blue	28	3,390	....	3,990	3,990	4,630	4,900
J. M. Wells Co. No. 2 Red	7	2,790	....	2,750	2,590	2,450	2,270
J. M. Wells Co. No. 2 Red	28	4,900	....	4,780	4,390	4,410	4,090
Cabot's Carbon Black	7	2,840	1,820	1,610	870	690	....
Cabot's Carbon Black	28	5,080	4,240	3,070	2,000	940	....

It will be seen that three different effects were produced: The blue appears to possess some hydraulic properties which caused it to show a steady increase in strength up to the highest percentage used (15 per cent of the weight of cement) at both 7 and 28 days. The red color caused a slight reduction in strength which is practically the same as the effect produced by other inert powdered materials in concrete. The carbon black produced a very great reduction in strength; 2 per cent of carbon black, reduced the concrete strength about 40 per cent. Bancroft in "Applied Colloidal Chemistry" 1921, states that "with a substance like carbon black which absorbs gas very markedly, as little as 5 per cent of the apparent volume may be due to the carbon black and a liter of carbon black may contain 2.5 liters of air." This peculiar property, no doubt, accounts for the effect on concrete shown by the tests.

Henry Turner Eddy

With the death of Prof. Henry T. Eddy last week one of the notable figures of an earlier generation in American engineering passed from the stage. For more than forty years Dr. Eddy taught engineering, retiring in 1912. During the past ten years he has been at work on various problems of the mechanics of reinforced concrete, in cooperation with C. A. P. Turner, of Minneapolis. Mr. Turner writes of Dr. Eddy thus:

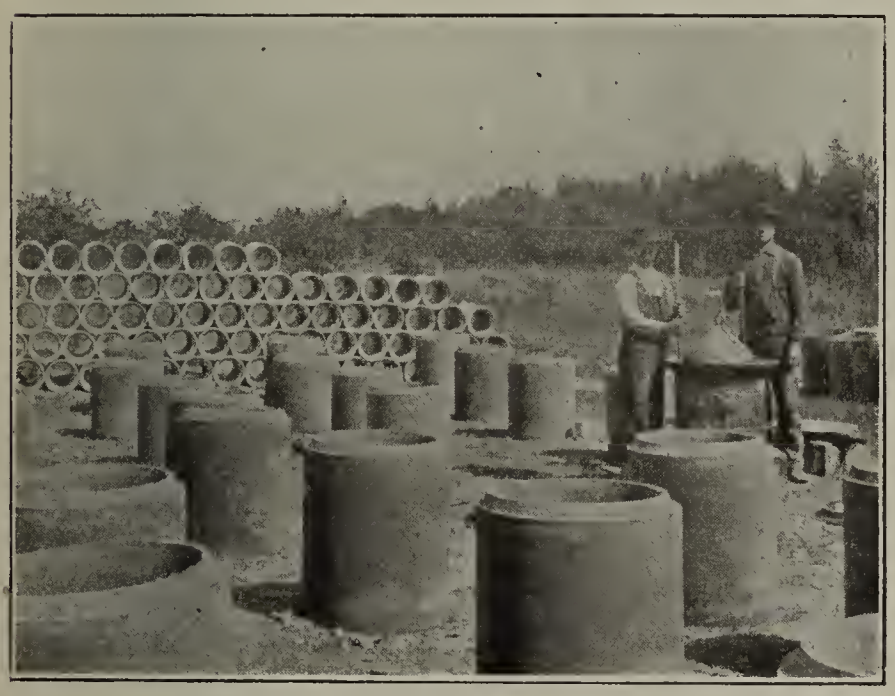
"With exceptional mathematical knowledge and high scientific attainment he combined the fine characteristics of simplicity, courtly manners and gentleness which caused him to be honored, loved and respected by all who came in contact with him."

The Concrete Pipe Business and Its Possibilities

There are rare instances on record in which a man has gone into a business that he knows nothing about and made a go of it, but these examples are extremely rare and are more than offset by the great number who have lost all the capital they invested when trying to play another man's game.

There are great possibilities in the concrete pipe and drain tile business, but, like any other real business, it is a wild gamble to go in blindly. If a man came directly from the farm and suddenly started a general store or a bank, the chances are about a hundred to one that he would fail, and everyone would say, "It served him right." Yet men are inclined to start in the concrete specialties business, and if they fail because of lack of experience, they blame concrete and say there is no market for their product.

There are miles and miles of concrete sewers, pipe and drain tile being laid every year—which seems to disprove this "no good" theory. The difference lies in the fact that the man who is selling this pipe knows something about the market. He knows where the farms are that need drain tile—those located on low-lying ground. He knows where sewers and pipe lines



Manufacturing concrete sewer pipes in Dunn molds.

are being placed and where culverts are wanted, and why concrete pipe will be most suitable for this work. He also knows how to make good concrete that will give perfect service under all conditions—the kind of concrete that is a credit to him and to the industry. He understands that clay makes fine bricks but poor concrete.

For the man who is willing to start out on a small scale and build himself up gradually and steadily there is a fine opportunity for business and profit in the manufacture of concrete pipe and tile. However, the man who goes into this business must make up his mind that he isn't going to make a fortune in a minute, but instead he is going into a business that will yield fine profits if handled in the right way, just like any other business. The concrete pipe business is not a get-rick-quick scheme, but rather a good, substantial business where the man who makes a careful study of his product and its market can be much more sure of success than in the majority of other fields. He must not try to do more business than his capital will allow and above all things he must make a study earnestly and steadily of his aggregate, his equipment, and his field; and govern the manufacture of his product accordingly.

After learning how to make the best kind of pipe and tile and studying the field to see where pipe can be used and what sizes will be most in demand, the next step is getting the product before the eyes of the people to be sold. This most important phase of the business is often the very one neglected. Many men have made the best kind of products but have lacked the ability to sell them after they are made. It isn't sufficient to have a nice pile of fine concrete pipe out in the yard, if the clay tile man is out talking to some farmer about the opportunity for increasing the value of some low-lying ground by putting down drain tile. If the farmer buys concrete drain tile after such an experience, it is the clay tile man's fault and is not due to the fact that there is a nice pile of concrete tile in the back yard of the concrete pipe maker.

There are many types of machines available for the man who goes into this business. The catalogs of the makers of this type of equipment show all varieties and sizes. The prospective pipe man can pick out a style that will be in keeping with the amount of capital he has to invest and he can add to this as his business increases. Many of the manufacturers are in a position to give information concerning the best methods of making tile and pipe, of laying out a plant efficiently, and they will also be glad to suggest the best way of obtaining publicity for the product.

Colored Mortar

A great many architects make it a standard practice to specify colored mortar in harmony with the color tone of the brick. This greatly increases the effectiveness of the color possibilities of brick and makes available many beautiful combinations.

The difference between a brick structure of permanent beauty and a mere building lies in the detail, the care, and the thought that the manufacturer, architect, and builder put in their work. The manufacturer of brick naturally wishes to see the full beauty of his product realized. The wrong color used in the mortar may cause the whole structure to look dull and uninviting, whereas the use of the correct shade may make the building one of the most attractive in the city.

Architects Appreciate Value of Color

The architect today grasps the opportunity for service to his client in the treatment of the mortar joint. He realizes that in producing a harmonious effect he must study not only the brick and bond, but also the color and texture of the mortar. By such care he is able to design a structure that is both artistic and durable. In all brick work, and particularly in ornamental design, the character of the mortar plays an important part. A very pleasant contrast may be secured by using a clear white lime mortar with white sand. Such a color is always appropriate, and furthermore, does not stain or become discolored as time passes. Both color and strength are permanent.

As mortar joints sometimes occupy nearly one-fourth of the wall area, the question of the amount of color necessary, the possible tones, and the durability of the color under exposure become important considerations. Only pure mineral colors should be

used as they are permanent in character and rich in tone.

Amount of Color Required

The Clinton Metallic Paint Co., of Clinton, New Yok, whose mortar colors have been on the market for a long time, recommends the following amounts of color to be added to the mortar required to lay 1,000 brick with a ⅜-inch joint.

Color	Pounds
Mortar brown	90
Hematite red	75
Special chocolate	75
Colonial buff	90
Pompeiian buff	90
Mortar black	125
Double strength black	75

Thorough Mixing Essential

The dry colors should first be thoroughly mixed with the sand. Blending colors is not advisable. Only one color should be used. In order to get uniform results, the mortar and color must be carefully measured or weighed as well as thoroughly mixed. After mixing the sand and color, the slaked lime paste or hydrated lime should be added. The paste should never be added while hot. If it is preferred, the colors may be made into a paste by the addition of water and then added to the mixed mortar. This method is favored by many contractors. Many different shades of tones of color are made possible by varying the amount of color added to the mortar. It should be remembered that the longer and more thoroughly the mortar is mixed the less color is required.

Compact Air Hoist

The Turbinair Hoist, built by the Sullivan Machinery Co., 418 Gas Bldg., Chicago, is a compact portable air-driven hoisting engine which may be set on a base or mounted on a column and used for handling drill steel, structural steel, timbers, etc., or for pulling cars, piling lumber, or any odd jobs of hoisting and hauling. It weights 285 lbs. and the drum will carry 500 ft. of 5/16-in. wire rope. Its capacity is 2,000 lb. lifted vertically at a speed of 110 ft. per minute under 75-air pressure.

The machine consists essentially of a cylindrical drum, mounted on a steel frame, and completely inclosing the operating mechanism. The motor has two cylindrical rotors, provided with right and left-hand helical flutes or vanes converging to a spur tooth in the center.

These two rotors mesh together as they revolve under the influence of the incoming air. The air is admitted at the axis of the drum through a hollow shaft and the motor revolves with the drum. The engine develops a high starting torque and is economical of power.

The hoist is provided with a friction cluth and brake. When both are released the rope may be pulled freely from the drum. The friction clutch may be locked in position and the load raised or lowered, controlled entirely by the throttle valve.

Efflorescence on Face Brick

"We read with considerable interest, the article appearing in the August issue of your paper, entitled EFFLORESCENCE ON FACE BRICK, in which you advise using MEDUSA WATERPROOFING in the mortar. This is an excellent suggestion and we are heartily in accord with same. We beg to respectfully suggest that there are other waterproofing compounds that will accomplish this purpose too, writes A. A. Alexander of the Avon Co., Heed Bldg., Philadelphia.

"However what we especially would like to call your attention to is that we sell a liquid which will prevent and put an end to efflorescence in brick walls which have already been erected. We feel certain that if you will refer any of your readers facing this problem to us, we will make a good friend out of him for you.

"If you are interested we will be glad to give you any information that you may desire.

"Assuring that our motive is to sell our material in behalf of better building."

Pulverized Coal Department

Mr. H. A. Kimber, formerly of the Quigley Furnace Specialties Co., is now in charge of the sales of the Quigley Pulverized Fuel Department of the Hardinge Company, 120 Broadway, New York, N. Y. This change was made owing to the acquirement by the Hardinge Company of the Pulverized Fuel Department of the Quigley Furnace Specialties Co.

Mr. L. W. Marso, who is in charge of the Branch Office of the Quigley Furnace Specialties Co., located at 427 Oliver Building, Pittsburgh, Pa., has now become associated with the Hardinge Company, 120 Broadway, New York, N. Y., and will continue in the Pittsburgh Office under the name of the Hardinge Company, but will specialize in the handling of the Quigley Pulverized Fuel Systems, which department has been acquired by the Hardinge Company from the Quigley Furnace Specialties Co.

Mr. O. M. Rau, formerly Consulting Engineer to the Philadelphia Rapid Transit Co., has now become associated with the Hardinge Company, 120 Broadway, New York, N. Y., and will specialize in the handling of Quigley Pulverized Fuel Systems as applied to boilers. This change took place with the acquirement by the Hardinge Company of the Quigley Pulverized Fuel Department of the Quigley Furnace Specialties Co.

Mr. W. O. Renkin has become assisted with the Hardinge Company, 120 Broadway, New York, N. Y., in the capacity of Managing Engineer of the Quigley Pulverized Fuel Department, since this Department of the Quigley Furnace Specialties Co. has been acquired by the Hardinge Company.

Pre-cast Concrete Structures

The Unit Construction Company contracting engineers, Title Guaranty Building, St. Louis, Mo., was formed in 1909 to develop and build precast reinforced concrete structures under patents owned by them covering a special system of beam, column and slab connections. The Company has built a large number of commercial structures by the "Unit Method."

In 1917 the Unit Construction Company in conjunction with Messrs. Herding & Boyd, Architects and Townplanners, undertook the design and construction of a housing development of two hundred and fifty one houses for the Youngstown Sheet & Tube Company at Youngstown, Ohio. These houses were built of precast reinforced concrete and have proved very successful. The Unit Company will gladly send literature rescribing this operation to anyone interested.

Large Reinforced Concrete Covered Reservoir

Vertical walls on limestone ledge as a bottom, with reinforced concrete slab roof, to be used for tennis courts. Walls poured continuously and slip forms used. Column forms used repeatedly.

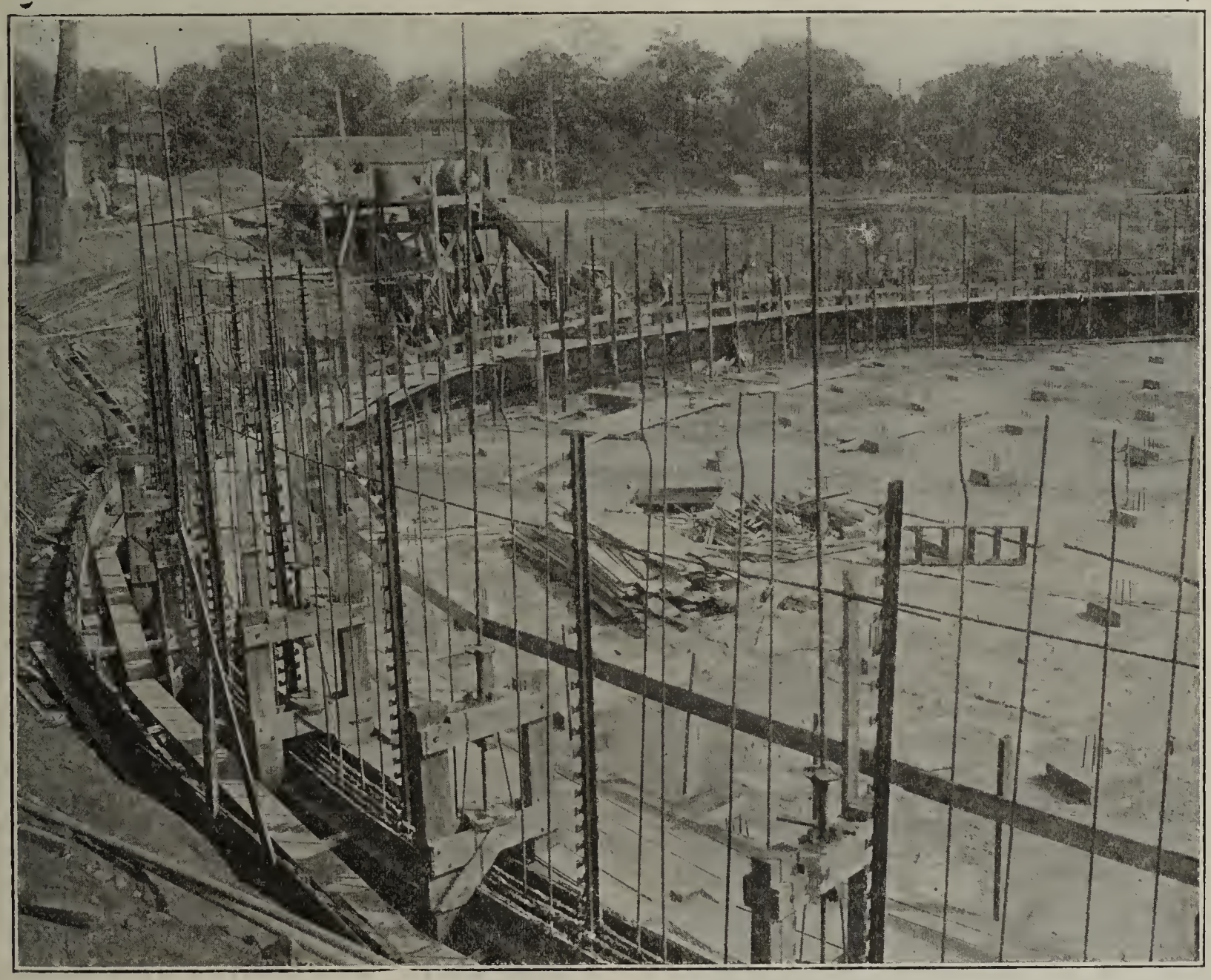
A two-million-gallon concrete reservoir has recently been completed at Arkansas City, Kan., which embodies some interesting features of design and methods of construction.

The water supply of that city is obtained from wells equipped with motor-driven, deep-well type, vertical centrifugal pumps, located approximately 1¼ miles from the high-service pumping station, and is pumped through a twenty-inch wood-stave pipe line to the reservoir located near the main pumping station. The reservoir provides a reserve storage for use in case of interruption of power service or other emergency demands, and which allows the well pumps to operate at uniform steady rates.

The site decided upon as most available for that reservoir location was a low tract of ground that had been of a swampy nature and had been partially filled in with old refuse, brick, tin cans, street sweepings and rubbish. Test borings were made and the results indicated approximately an average of eight feet of old fill and original loam and two feet of water-bearing sand overlying a solid limestone stratum, requiring six feet of tight sheeting to hold the lower banks. The ground water level was approximately four feet above the rock surface. The rock surface was fairly smooth and level, having a grade or dip of less than 8/10 of a per cent. Several faults or cracks from ¼ inch to 1 inch wide, averaging about twenty feet apart and running at right angles to each other were cleaned out and grouted full with a 1:2 cement mortar, and after chipping off some of the uneven places, the entire rock surface was washed with a cement grouting and used as a floor.

The reservoir is circular, of reinforced concrete, ring tension type, 156 feet inside diameter and designed for a depth of fourteen feet of water. It is covered with a five-inch reinforced concrete roof slab carried by 10x15-inch beams spaced twelve feet centers each way and supported by 10x10-inch concrete columns. The roof was divided by expansion joints into slabs twenty-four feet square and rests freely upon the beams. The slab was designed for 90 pounds live load in excess of the dead load. The entire roof was given a slope of eight inches from the center to the outside walls.

A trench was excavated in the rock to provide a sub-footing under the walls and to secure a good bond to prevent leakage. In order to provide for the indeterminate cantilever stresses, the sub-footing was fin-



Construction Details of Arkansas City Reservoir. Shows methods of supporting reinforcing bars and of raising slip forms. Concrete mixer in background. Wheelbarrow runway inside of forms.

ished off smooth and an asphalt expansion joint was provided between the sub-footing and the wall footing proper.

The wall was made fourteen inches thick without taper toward top, in order to facilitate the use of slip forms. The horizontal steel was placed in two rows and held in place by vertical standards, six feet centers, built up of 3-inch channels, to which short strap steel lugs, with notches for holding the bars, were riveted at the required intervals. The channel standards facilitated the placing of the steel and insured the proper spacing and prevented the displacing of the bars during the pouring of the concrete. The standards were accurately centered and held in place by braces until the footing had been poured and then the conform to roof slope, so that all the column forms were of same length, simplifying the construction and placing of forms. A part of the roof was poured during freezing temperatures, the work being protected by using a canvas tent covering and heating with steam coils, heating sand and water for mixing, and covering the completed work with paper and straw before removing the tent to the next section.

The location of the reservoir being on public park property, the top slab was given a float and trowel finish, and the manhole openings and ventilators were so placed that two tennis courts could be laid out on top of the reservoir. Pipe couplings or sockets were set in the roof slab for installing net posts and also around the wall for fencing the entire area.

Reservoir With Roof Partly Placed. At right, tent for covering new concrete in freezing weather.

standards were sufficiently rigid to be self-supporting.

A system of slip forms four feet high and in sections twelve feet long were made up of 1-inch shiplap and assembled and centered in place. The forms were filled within six inches of the top and were then raised by means of the ordinary slip form jack operating on a one-inch pack rod. The jack rods were spaced approximately eight feet centers and two men made the circuit twice an hour raising the form about one inch each time. The one-inch jack rods were cut off at the top of the wall when the pouring of concrete had been completed.

The wall concrete was run continuously, requiring a total time of eighty hours for completion. There were three eight-hour shifts, each consisting of ten laborers and a foreman mixing and placing concrete, three men placing and wiring steel, two men operating form jacks and two carpenters shifting runways and miscellaneous work. Two mixers were placed on opposite sides but owing to shorage of labor only one mixer was in peration at a time, the crew changing from one mixer to the other every hour. Concrete was conveyed from mixers to wall in wheelbarrows on board runs.

This method of construction eliminated all construction joints and gave a smooth finished surface which under water test showed practically no leakage, and only slight leakage was found through the small fissures in the rock bottom. Column footings were placed and their tops carefully graded from center to walls to

The principal quantities in the construction were 7,162 cubic yards of earth excavation; 1,538 cubic yards of concrete; 71.7 tons of reinforcing steel and 4.2 tons of channels and miscellaneous.

The total cost of the completed reservoir was $52,887.21. The total reservoir was designed by Burns & McDonnell Engineering Company, of Kansas City, and constructed by Ray & Son, contractors, of Baxter Springs, Kan.—and the work was inspected and supervised by Charles W. Lusk, city engineer of Arkansas City.

Smooth, Watertight Concrete

A smooth, uniform concrete surface is always desirable. In the construction of modern homes much concrete is used in foundations, steps, porches, sidewalks, as well as various cast stone ornamental objects, such as benches and flower boxes. Attention is naturally drawn first to their finish. If it is uniform and free from blemishes, we feel that the work is first-class and are instinctively sure that the concrete is good. On the other hand, if it is marred by stone pockets or patches, we are more critical and doubt whether the work will prove acceptable.

Hydrated Lime Acts as a Lubricant

The addition of hydrated lime to the concrete will help materially in obtaining the desired uniform,

smooth surface. This is because it acts as a lubricant in the mix. It is well known that a rich lime paste works as smooth as butter. When hydrated lime is added to concrete, smoothness is imparted to it to a considerable degree. This makes it possible to place the concrete in the forms more easily and helps to attain a smooth and uniform finish on the work. The entire mass of concrete is denser, and consequently more durable and stronger.

For Increased Workability

For general concrete work in connection with building, the workability of the concrete may be definitely improved by the addition of hydrated lime to the various mixtures, in the quantities indicated below:

Hydrated Lime Per Sack of Cement	
1 : 1½ : 3 mix	5 pounds
1 : 2 : 4 mix	8 pounds
1 : 2½ : 5 mix	10 pounds
1 : 3 : 6 mix	12 pounds

Importance of Watertightness

In basement walls and floors, as well as in ornamental boxes and basins it is highly desirable that the concrete shall be watertight. This property may be attained in either of two ways. One method is to use some waterproof paint, which, however, is only a temporary remedy, and the other is to make the concrete permanently watertight by what is known as the integral method. This may be accomplished by a rich mixture, carefully graded and proportioned aggregates, and high-class workmanship. Such a method is usually too expensive for the average builder and he must find other means of obtaining the same result.

Hydrated Lime for Waterproofing

Concrete is an intimate mixture of san dand gravel, or crushed stone, bound together by cement. If it is scientifically proportioned, the sand and cement will fill all the voids, but in ordinary concrete this, unfortunately, is not always the case. Consequently there are some small spaces still open and the material must be used that will not injure the concrete, but will fill or seal these voids. Such a material is found in hydrated lime.

Hydrated lime comes to the job in paper bags containing 50 pounds, or about 1¼ cubic feet. It is a dry fluffy powder, that may be easily added to the mix, and serves to fill up the excess voids in the concrete mixture, thus making the concrete permanently watertight.

Many cement block manufacturers add hydrated lime to their mixes, both for making them more workable and also for making them watertight. This avoids many of the criticisms formerly directed at concrete blocks on account of their rough and unfinished appearance and also because they were so porous. The blocks containing hydrated lime are uniform in texture as well as appearance and moreover, are watertight.

The concrete mixes most frequently used may be made permanently watertight by adding hydrated lime in the following amounts:

Hydrated Lime Per Sack of Cement	
1 : 1½ : 3 mix	7 pounds
1 : 2 : 4 mix	10 pounds
1 : 2½ : 5 mix	12 pounds
1 : 3 : 6 mix	15 pounds

The sand and stone used should be of good quality and free from dirt. Mixing, consistency, and tamping should be watched very carefully. Hydrated lime should not be considered as a cure-all for concrete troubles, but rather as a means of "making good construction better."—(National Lime Association, Mather Bldg., Washington, D. C.)

Plant of River Rock and Gravel Co. at Niles, Cal.

The Niles, California, plant of The River Rock Gravel Company, Wm. H. Ford, President, presents some interesting features from an engineering standpoint. The deposit is located in a charming valley, is, by actual tests, at least 2,500 feet in dept (!) and the present excavation of material lies across a sizable stream from the plant location. The material is loaded with a two and one-half yard drag-line outfit, electrically operated. Whenever the surface cut is exhausted it is planned to move the excavator to the lower level and take out a second cut. The material is loaded into cars of seven-yard capacity which are hauled by a gasoline locomotive from the excavator, under a railroad and over a trestle, across the stream to a hopper, where a belt conveyor carries it to the screening and washing plant. Over sizes are separated and crushed in Symons disc and Gates crushers and the sizing is done by revolving screens. Large settling tanks separate the water from the sand and leave the products free from foreign matter.

With the exception of an oil-burning locomotive crane, which is used for switching cars and handling material into and out of storage piles, the plant is electrically operated. A well-equipped machine shop and warehouse for supplies and spare parts reduces delays to a minimum. The plant was designed by J. C. Buckbee & Co., Chicago, has been in operation for several years and, despite the extremely high value of the land excavated (as orchard property) has yielded very satisfactory returns to the owners.

The Electrification of Excavating Shovels

The first excavating shovels of any size to be electrified were put in operation about 1908, being operated by direct-current motors, as it was thought at that time alternating current was not suitable for this application. A further reason was that there were no

Class 14-B. Electric shovel in limestone quarry.

satisfactory alternating-current motors available nor any satisfactory system of control. These shovels were not altogether satisfactory from the standpoint of output as the power requirements were underestimated and the power supply inadequate. About 1909 the first shovel with alternating-current motors and control, was installed in the quarry of the Kokoma Stone Co. In the beginning, this shovel gave some

trouble due to unsuitable control apparatus, and also to some of the details of the application of the motors to the shovel. After these difficulties were eliminated, and the equipment simplified, the shovel gave satisfactory results and is in operation to date. The simplicity and reliability of the electrical shovel, even in the hands of people entirely unfamiliar with the electrical apparatus, has been amply demonstrated, as no electrician, other than repairmen or wiremen, are employed, but the shovels being operated by steam-shovel men. Since this time, a considerable number of shovels, using both alternating-current and direct-current motors, have been installed. Most of the direct-current shovels have been used for electric trolley line construction; some have been used with motor-generators on large power lines stripping overburden from coal.

Within the last few years, there has been a great development in loading of coal which lies too near the

Machine used principally for canals and stripping operations and the excavating shovel principally for loading and removing the material.

surface to be profitably mined. A large revolving type shovel is used for stripping the overburden from this coal and the smaller loading shovel used for loading it into the cars. In some instances, a dragline excavator has been used for removing the overburden.

Similar to the coal stripping operations are the ore stripping operations and the loading of ore. Electric shovels have been successful in the hardest and most severe tests in handling iron ore, copper ore, blasted rock in quarries, railroad cuts and canals. Levee work and drainage ditches have proven another field for successful operation of electric excavating machinery.

The Electric Development Company is supplying power for four large dragline excavators in service near Cape Girardeau, Mo. These excavators are used in reclamation work. The Sunnyside Electric Co. of Wheeling, West Virginia, is supplying current for several large electric shovels used in stripping operations and an equal number of smaller shovels used in loading the coal. There are approximately 15 large electric shovels stripping coal in the different fields in this country. The Hydro Electric Power Commission of Canada is using several of the largest shovels in the world—320-ton shovels, with approximately 600 h.p., one-half hour rated motors, and several smaller shovels for digging their large canal around Niagara Falls.

The Chile Exploration Company is using 10 large electric shovels and has others on order. The United

No. 103-C. Electric shovel loading blasted granite, Niagara Falls, Canada.

States Government is using them in reclamation work.

In every case, these shovels have proven eminently satisfactory, as evidenced by repeated orders in many cases.

There are ten large shovels, mostly of the railroad type, digging the heavy Swedish iron ore in one of the large mines of Sweden. Many users have one, two and three of different sizes in different parts of the country.

300,000 Tons of Trap Rock Loosened

Somebody pressed a little button and the whole face of the great cliff simply fell over. Pressing the button had discharged 45 tons of low freezing dynamite, had loosened more than 300,000 tons of trap rock, and had furnished 5,000 spectators the expected thrill.

This was at Fresno, California, on Sunday afternoon, March 20, and A. R. Kerstetter, the energetic manager of the Peidra Rock Company, remarked the blast had been a success. The changed aspect of the landscape indicated that Mr. Kerstetter knew whereof he was speaking.

It was the biggest shot ever fired on the Pacific Coast, it is believed, and it attracted thousands. More than 2,000 automobiles were parked nearby and when two long blasts of a steam whistle announced that something serious was about to happen the movie cameras went click-click, folks held their breath and everybody said, "Oh!" as the half-million and more tons of rock toppled over.

The tunnels were drilled 60 feet, in 310 feet cross cut by three Sullivan drills. The crushed rock is loaded by two steam shovels into forty, 4 yd. Western dump cars.

Costly Railroad Re-location

Shifting 15 miles of double-track railroad around Huffman dam, Miami Conservancy District, required excavating 657,000 yards, mostly rock in one cut 120 feet deep, placing 390,000 yards of embankment, cost more than $3,237,000.

The $25,000,000 flood protection works in the Miami valley, Ohio, that are now in an advanced stage of construction by the Miami Conservancy Commission, include the Huffman dam, an earth embankment 65 feet high, 3,340 feet long and nearly 400 feet wide at the base, which contains 1,547,000 yards of earth and, impounding the drainage area of 671 squaremiles, forms a retarding basin that has, in a flood like the disastrous one of 1913, a submerged area of 7,300 acres and retains 124,000 acre-feet of water with an average maximum depth of 17 feet and a possible maximum depth much greater.

The dam is built across the valley of the Miami river at a point about 6 miles above the city of Dayton and at a point where there were located the two double tracks of the Erie and Big Four Railroads at an elevation about 60 feet below the top of the dam.

Diversion and Elevation of Tracks.

Both roads have large and costly yards in Dayton, the elevations of which could not be changed, and as the greatest permissible grades from these yards would not bring the track level within 35 feet of the top of the dam at the dam site it was necessary to divert the alignment of both roads to a point beyond the end of the dam. This necessitated a long, deep cut through the rocky hillside, beyond which the still ascending tracks continued for a long distance, below the level of the flow line in the reservoir, making it necessary to protect the tracks by very heavy levees on both sides to exclude, in time of flood, the water that will then fill the basin through which the tracks pass.

The two double-track systems are combined to form a single four-track system for the purposes of re-location, and were built 14 feet apart on centers for the first 7 miles from Dayton to a point a mile beyond the dam, where the distance between tracks is increased to 60 feet to the end of the relocation, which is about 15.22 miles long. The tracks are run on a grade of 0.3 per cent to a point in the retarding basin beyond the dam, where they reach the elevation of the flow line. The new location is nearly 8,000 feet longer than the original location of the two double-track systems, and it also involves an increase of 93 degrees in curvature and a considerable increase in grades, which with operating expenses, together with some other items of maintenance, are capitalized at $579,974. This sum added to $2,717,120, makes a total charge to the Conservancy District of $3,237,094, exclusive of the cost of right-of-way amounting to 345 acres.

Huffman Dam Cut.

The principal feature of the re-location is the deep cut in which the tracks pass about 400 feet south of the south end of the dam and at an elevation 35 feet below its crest. This involves a rock cut 120 feet in maximum depth, 4,500 feet long, 72 feet wide at the bottom and very much wider at the top, where about 54,000 yards of earth were excavated. The remaining 593,000 yards of spoil was rock, consisting of a 35-foot stratum of Brassfield formation, 44 feet of Elkhorn and 41 feet of Cincinnatian formation.

Making a rock cut for relocating tracks of the Erie and Big Four railroads around Huffman Dam, Ohio. Shows how the rock was blasted in a long windrow ahead of the steam shovel, the latter then following and loading the shattered material into the cars.

All of the rock was drilled by five Sullivan steam drills, four Sanderson-Cyclone well drills and two jackhammer drills. The rock drills averaged 60 to 65 feet of 3¼ to 3½-inch holes in each 10-hour shift. The well drills averaged 40 to 50 feet in 10 hours. About 90 per cent of the holes were sprung and then charged with from 100 to 250 pounds of 45 per cent Du Pont dynamite, which was used after so many springs had been encountered that the original use of ammonia dynamite was superseded.

The Brassfield stratum was sufficiently solid to be excavated on a 1:1 slope with a 8-foot berm at the foot. The Elkhorn stratum, which is much softer, was greasy and was excavated on a 1½:1 slope, with a 4-

foot berm at the foot. This could have been accomplished by the steam shovel without blasting, but the rock was so tough that blasting was economical. The Cincinnatian formation consisted of layers of limestone separated by laminations of shale, which when first exposed was hard, but softened and sloughed so rapidly by exposure that in a month it could be picked to pieces. It was excavated on a 1:1 slope.

Blasting.

The blasted rock was handled by two 70-ton steam shovels working together one 10-hour shift, and by one of these shovels working continuously day and night. The shovels handled an average of about 4,000 yards each per 10-hour shift, loading it into standard gauge 12-yard Western dump cars hauled by locomotives and used for making the embrankment and levees.

When the steam shovel was operated on the same level as the dump cars, the rock was excavated in 16-foot lifts and the holes were spaced 13 feet apart.

Shows the full scope of the work of excavation, with two Sanderson Cyclone well drills in the foreground and the Osgood steam shovel, Western dump car train and Sullivan drills in the background.

When the cars stood on the lift above the steam shovel track, the rock was excavated in 8-foot lifts in which the holes were spaced about 7 feet apart. At the bottom of the cut the last lift was 28 to 30 feet high and 2,500 feet long.

Enough explosive was used to shatter the rock and throw it into a long windrow, which was removed by the steam shovels travelling from end to end and loading it into dump cars alongside. The excavation was made by the Walsh Construction Company, Davenport, Ia., under the superintendence of W. A. Durkin and was accomplished without serious injury of any of the employees.

Embankments.

The grade between Dayton and the dam is wholly in embankment which required 106,000 yards more material than was available from the cuts. The construction of the levees also required so much embankment that the embankment and fills for the total job were unbalanced by an amount of 400,000 yards, most of which was secured by increasing the width of the cut and the remainder by opening borrow pits.

Betwen Dayton and the dam two railroad bridges were eliminated by the construction of a cut-off channel in the river which required the excavation of 34,000 yards of material by clamshell buckets and 10,000 yards by teams and scrapers.

On the upstream side of the dam there are twin levees 200 feet apart, 35 feet in maximum height and 1½ miles long, together requiring 469,000 yards of embankment, nearly three-fourths of which were taken from the Huffman cut. About 40,000 yards were furnished by excavating between the levees with an elevating grader and dump wagon for the sub-grade of the railway tracks. For 3 miles the embankment in wet, miry soil was obtained by side borrow with elevating grader, constructing a narrow embankment which was afterwards widened by side dump from cars hauling spoil from the steam shovels in the cut.

Track Laying.

The tracks were laid with 90-pound rails and creosoted 7x8-inch ties 8½ feet long and 18 inches apart on centers. Standard tie plates are used on all curves and the road is ballasted with gravel having a minimum thickness of 12 inches below the bottoms of the ties and requiring 3,490 cubic yards per mile of single track.

Because it was necessary to shift the original location of the tracks near the dam in order to commence construction on the outlet conduit at the earliest possible date, apreliminary re-location about 1⅓ miles long, was made which required 33,800 yards of rock excavation and provided for traffic during two years before the permanent re-location was completed.

The work was done by contract and was executed under the supervision of railroad engineers and of the division and the assistant engineers of the Conservancy Commission, of which Arthur E. Morgan is chief engineer and Charles H. Paul assistant chief engineer.

Ditch Blasting

A ditch blasting test in snow and ice of the new non-freezing straight dynamite manufactured by the Du Pont Company was made during the last few days of November, near Wausaukee, Wisconsin. The ditch was blasted by the propagated method and the dynamite was loaded through 8 inches of snow and about one-half inch of ice in wet soil, the temperature of

which was 35 degrees Fahrenheit at the point of the load. Moreover the dynamite used had been exposed in storage to freezing temperatures for several weeks. The results were absolutely perfect in every respect.

The test is regarded as of great importance to farmers and other users of dynamite for open work during the winter months. Straight dynamite has for years been the standard of the world in nearly every kind of open work, but a disadvantage has been its liability to freeze at temperatures below fifty degrees Fahrenheit. Any dynamite loses some part, if not all, of its efficiency when chilled or frozen and many attempts have been made to make the explosive low-freezing. The test reported of the ditch blasting in snow and ice in Wisconsin shows that thawing with its loss of time and attendant danger has practically been eliminated.

Stucco Questions and Answers

By EDWARD D. BOYER, Cement Expert*

1. *What is Portland cement stucco?*

Portland cement stucco is the term given to a mortar consisting of Portland cement, sand or other aggregates. It is used for forming the exterior surface of buildings.

2. *To what is Portland cement stucco applied?*

Portland cement stucco is applied to concrete blocks, hollow tile, concrete, brick, metal lath and wood lath.

3. *What backings are the best? (Named in order.)*

Concrete, concrete blocks, hollow tile and brick are undoubtedly the best. Next to them comes metal lath, stucco board and wood lath.

4. *Should wood lath be recommended generally?*

It is not especially advisable to use wood lath on account of the fact that it readily absorbs moisture from the stucco mortar and is liable to swell. When the wood shrinks in drying out, it very often pulls the stucco with it and causes cracking. Our recommendation on wood lath is to use one that has been properly cresoted in order to prevent the absorption of moisture.

5. *Which is the best metal lath to use?*

Our recommendation on metal lath is to use a metal lath that has been galvainzed after expansion or heavily

6. *Will Portland cement stucco crack?*

Portland cement stucco will not crack if the work is carefully done and properly protected.

7. *Should retempered mortar be used?*

No. In mixing mortar for stucco, only such quantities should be prepared as can be used up within 30 minutes, after which time the mortar is liable to take its initial set. Retempered mortar has not the strength and durability of fresh mortar, and should never be used.

8. *Should stucco be applied in freezing weather?*

nder no circumstances should Portland cement stucco be applied in freezing weather, because the mortar does not have an opportunity to set properly; nor must it be applied when there is danger of temperature falling below freezing at night.

9. *Should hair or fibre be used in mortar?*

Hair has the advantage in the first coat of cement stucco when applied on metal lath, in that the hair prevents the cement mortar from falling behind the metal lath, and only first quality long hair, free from foreign matter, should be used or a long fibre well combed out, which can be well distributed through the stucco by thorough mixing. Hair should not be used on sheathed walls.

10. *How many coats should be used?*

Recommended practice calls for three coats, consisting of two ⅜-inch coats, using gray cement, and one finish coat of ¼ to ⅜-inch in thickness, using either gray cement or white cement.

Two-coat work is also successful, particularly on stucco board.

11. *Can two coats be used for hollow tile walls?*

Yes, but it is better to use three-coat work in order to get the proper thickness of 1 inch for the stucco, which is required so that the tile joints do not show through. The first coat is really used to secure the proper bond to the hollow tile and just about covers the corrugations.

12. *How soon after application when using three-coat work should the succeeding coats be applied?*

After the first coat is applied it should stand at least 24 hours before applying the second coat. The third coat should be applied not less than 7 days after the second coat has been applied.

13. *How should the first and second coats be prepared in order to secure a good bond when placing the succeeding coat?*

These coats should be carefully scratched before setting, and wetted thoroughly before applying the succeeding coat.

14. *Will cement stucco hold moisture, making the house damp?*

If the mortar is mixed properly, cement stucco will be moisture-proof.

15. *What does the Atlas Portland Cement Company recommend for waterproofing cement stucco?*

We do not consider that Portland cement stucco requires the incorporation of any waterproofing compound. We believe cement is its own best waterproofing, and if properly proportioned and mixed and applied will be waterproof in itself.

16. *What is the function of hydrated lime when used in Portland cement stucco?*

Hydrated lime acts as a void filler, causing the motar to be more dense and plastic, with greater spreading capacity and working more easily under the trowel.

17. *If hydrated lime is used, should it be used in all coats?*

Yes, because it makes the mortar easily worked.

18. *What is the covering capacity of one barrel of cement for stucco when mixed 1 part of cement and 3 parts of sand or aggregates and placed ⅜ inch in thickness?*

Taking into consideration this mixture and thickness, one barrel of Portland cement will cover approximately 40 sq. yds.

19. *What is the covering capacity of one barrel of cement for stucco when mixed 1 part of cement and 2½ parts sand or aggregates and placed ¼ inch in thickness?*

The covering capacity of one barrel when mixed and placed in this way will be approximately 51 square yards.

20. *Does stucco increase in strength with age?*

Like all forms of concrete construction, stucco increases in strength with age.

21. *Has stucco with a white cement finish the same strength and durability as a gray cement finish?*

ATLAS-WHITE is a Portland cement of the greatest strength and quality. It has the same physical characteristics and is manipulated in the same manner as gray Portland cement. The materials entering into its manu-

---

*of the Atlas Portland Cement Co.

painted, weighing not less than three and four-tenths (3.4) pounds to the square yard, or woven wire lath, galvanized or painted, 19-guage, two and one-half (2½) meshes to the inch.

facture are so selected that they are free from those elements that give color to gray cement, and the product therefore, is white.

22. *How many square yards of three coat ordinary stucco can a plasterer and two helpers mix and apply in 8 hours.*

In ordinary stucco, one man and two helpers can finish 20 to 25 square yards per day.

23. *What are the chief advantages of stucco construction?*

Stucco construction is economical in that there is but one cost and that is the first cost in application. It eliminates painting costs and upkeep costs, and a stucco house is always cool in summer and warm in winter. Greater variety in color and surface can be secured when using stucco construction than in any other form of building. It is a fact recognized by many architects that stucco construction allows them to bring to greater details in design.

24. *What is color aggregate stucco?*

Color aggregate stucco is a term applied to the finish coat where such crushed color aggregates as marble, granite, gravel grit and color sands are used in the mortar, together with the white cement and white sand.

25. *How is color aggregate stucco handled?*

Color aggregate stucco is handled under two methods —one known as the "integral" and the other as the "thrown on" method.

26. *What does the "integral" method consist of, and how is it applied?*

The "integral" method consists of mixing the color aggregates with white cement and sand. After application to the wall, the mortar is allowed to harden sufficiently so that when sponging the surface in order to expose the aggregates, the mortar will not be washed away. In other words, with this method the idea is to wash the thin film of cement from the surface of the stucco in order to expose the aggregates and bring out the beautiful color tones. Very often the surface can be washed in three hours. However, this depends upon the atmospheric conditions, and on a damp day as long a time as six or seven hours must elapse.

27. *What is the "thrown on" method?*

The "thrown on" method consists of the application to the wall of a mortar of white cement and white sand, and the throwing on of the color aggregates immediately after floating the mortar.

28. *In the "thrown on" method, how should the color aggregates be applied?*

It is a good practice to have a helper follow up the plasterer and immediately throw the aggregates on to the mortar and press in with a wooden float. It is very necessary that this be done immediately after applying the mortar to the wall, so that the mortar will have no opportunity to set before using the aggregates. If much time has elapsed between the procedure of appying the mortar and throwing the aggregates on, very often it will be found that the aggregates bounce back and very little is imbedded in the mortar.

29. *Which is the better of the two to use, "integral" or "thrown on"?*

We consider the "thrown on" method the better, as it brings out the color of the aggregates in a more pronounced way. Of course, the surface presented is a matter of taste.

30. *Can ordinary gray cement be used in place of white cement in color aggregate stucco?*

Yes, but the resulting finish will not show up the color of the aggregates to good advantage and while a certain amount of texture is added to the stucco, still it has not the beauty as when using white cement.

31. *Is color aggregate stucco difficult to handle?*

Yes, and should not be attempted except by an expert plasterer and our specifications should be followed out as closely as possible.

32. *Where can the aggregates be obtained?*

A list of sources of color aggregates is included both in "Color Tones in Stucco" and "Guide to Good Stucco," published by the Atlas Portland Cement Company. However, we are receiving names and addresses of new sources right along and it would be advisable, should anything develop on a job as far as color aggregate is concerned, to take the matter up with the office.

33. *Can any color be obtained?*

Yes, all the principal colors can be obtained.

34. *Can combinations of aggregate be used?*

Yes, and very often combinations of colors add life and texture to the finish. As it is possible to obtain as high as 30 or 40 shades in aggregates, many combinations are possible.

35. *What is the cost of the aggregates?*

As a general practice the prospects should be referred to the shippers of the material, but it would be safe to mention that the cost is $8.00 to $25.00 per net ton at sources of supply.

36. *What size of aggregates can be obtained and which is the best size to use?*

Aggregates can be obtained finely crushed, in form, also $\frac{3}{16}$ to ½ inch in diameter. For the "integral" method no larger aggregate than ¼ inch should be used. For the "thrown on" method any size up to ½ inch can be used.

37. *Will the Atlas Portland Cement Company send a man to get a job started?*

No. This would involve too great an expense if followed generally. Therefore, it is not advisable to make any exceptions.

38. *What is the cost of color aggregate stucco?*

From $1.85 to $2.25 per square yard for the entire three coats of stucco, bearing in mind that the color effects are obtained in the final coat, the base coats being of ordinary gray stucco.

39. *What is the cost of stucco with color aggregate in the finish coat as compared with straight gray stucco in all coats?*

Color aggregate stucco costs about 33⅓ per cent more.

40. *What is the cost of stucco with a color aggregate finish coat as compared with a white cement finish coat?*

Probably not over 10 per cent to 15 per cent higher for the color aggregate stucco.

41. *What is the cost of color aggregate stucco as compared with (a) stone construction, (b) brick construction, (c) frame construction?*

Less expensive than stone.

Less expensive than brick.

Slightly more than frame.

42. *How many square yards of color aggregate stucco can one plasterer and two helpers wash in 8 hours?*

About 20 square yards.

43. *What is the best method to be used in washing?*

The surface can be washed with an ordinary sponge, and care must be taken to avoid too much water so that the setting mortar will not be saturated.

44. *If the surface is not hard enough to wash the same day, what should be done?*

The surface should be allowed to stand until the next morning and then acid washed, using a solution of one part of muriatic acid (hydrochloric) and 5 parts of wa-

ter. The surface then will be found hard enough to scrub with the stiff fibre brush.

45. *Is color aggregate stucco as durable as regular gray or white cement stucco?*

Yes, color aggregate stucco is as durable as regular gray or white cement stucco.

46. *Will the surface eventually discolor?*

No, the surface will not discolor as the color given to the finish is a natural one in the form of aggregates.

47. *Will acid wash injure the surface?*

If the proper precautions are taken, acid wash will not injure the cement stucco surface. After scrubbing with acid, it is absolutely necessary to flush the surface with water immediately, so that the acid will cause no disintegration of the cement stucco.

48. *Is it difficult to secure good joining when the scaffolding is moved?*

Yes, and this is especially true in color aggregate stucco, although there should be no joints. It is entirely possible to secure a good joining by proper handling. By the way, each wall should be completed on the day that the work is started.

49. *How does color aggregate stucco compare in appearance with (a) frame construction, (b) brick construction, (c) vitrified hollow tile construction?*

Color aggregate stucco is more pleasing than frame construction because the stucco finish has an attractive texture. (a) In frame construction only one-tone effects are possible; (b) in brick construction beautiful texture of brick finishes are possible, but variety of color, which adds materially to the texture, cannot be secured; (c) in vitrified hollow tile the same can be said, in that vitrified hollow tile has no texture and presents a one-tone effect, while the appearance of color aggregate stucco is just the opposite.

50. *How much color aggregate is required for 200 square yards of stucco (a) "integral" (b) "thrown on"?*

In the "integral" method for each 200 square yards there is required one cubic yard (2,600 pounds); (b) for the "thrown on" method it would be safe to say 1¼ yards (3,000 pounds).

51. *If one-tone effects in color aggregate stucco are desired, what should be used for coloring?*

Color aggregates can be secured in finely crushed form and should be mixed with the white cement and white sand in the quantity desired, depending, of course, on whether light or dark shades are wanted.

52. *What is the advantage of using color aggregates finely crushed for coloring as compared with mineral pigments?*

At the present time, greater variety of color can be secured in finely crushed aggregates than in mineral pigments. Aggregate coloring will not fade, which may occur when using mineral pigments.

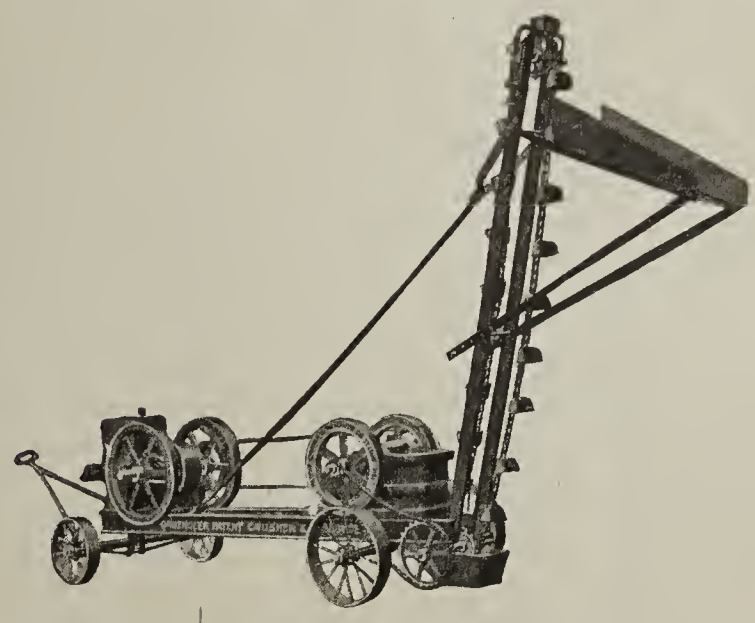
53. *What is the method of supplying samples of aggregates to prospects?*

Direct requests for samples can be made from the sources shown in our literature. Each one of these shippers has agreed to supply samples of aggregates to the prospects. However, we will be glad to see that any prospect is supplied with samples of color aggregates if the prospect will advise definitely the finish desired.

Gruendler Stone Crusher

The Gruendler Patent Crusher and Pulverizer Co., 904 North Main street, St. Louis, Mo., has put on the market the Gruendler good road builder which is a complete plant comprising a crusher, elevator, screen and bin which, although mounted on portable trucks for its transfer along the highway, is as strong as any stationary outfit, and can be separated into independent crusher and elevator installations.

The crusher has a fixed and movable jaw set with an adjustable distance between them governed by



toggle plates and wedges of several sizes, to regulate the size of the crushed stone. The portable machine is built in 7x8, 8x12, 9x14, 10x16 and 12x20-inch sizes, with or without a folding elevator and a gasoline or kerosene engine. The approximate weight varies from 2,500 pounds to 11,000 pounds and the capacity runs from about 1 ton to 20 tons per hour of ¼-inch to 3-inch products. The company also manufactures cylindrical and conical revolving and shaker screens and a special friction clutch pulley for use when the crusher is driven by a gasoline tractor or engine which can be freely started before engaging the crusher.

Dodge Friction Clutch

The Dodge Manufacturing Company, Mishawaka, Ind., probably owes as much of its reputation to the Dodge friction clutch or cut-off coupling as to any other item in its comprehensive line of power transmission machinery. The Dodge clutches, of both solid and split types, have been on the market for a long time and more than 50,000 are in operation. They are made for all kinds of service and each clutch is a separate and distinct mechanism, not in any way a part of the pulley, sheave, gear or sprocket which may be mounted on its sleeve. This fact is important because it enables the user to change the speed of a machine, when necessary to increase efficiency, simply by substituting for the pulley in use another of proper diameter. The clutches respond readily to the mill of the operator and adjustments are simple and quickly made. Their friction members are high in pulling power and durability and may be renewed, if necessary, with little trouble and at low cost. In almost every plant there is at least one machine unnecessary to operate all the time. If such a machine can be thrown out of service when not needed, the power required to run it is saved. Not only can certain machines be stopped advantageously a part of the time, but in many instances the use of a whole section or floor or a factory can be dispensed with. The Dodge clutch makes it possible for a manufacturer to avail himself of every economy of this kind. Daily saving may be slight, but in the course of a year the savings probably will amount to more than the expense of installation.

Two Recent Methods for Proportioning Concrete

By H. H. SCOFIELD

Since the beginning of modern use of concrete the method of proportioning has in the main been one of arbitrary selection. Later, and more especially in comparatively recent years, more attention has been given to the development of rational practical methods of determining the correct proportions by a systematic study of the materials used and the conditions involved in the manufacture of the concrete.

The first of these has been the method of arriving at quantities by determining the voids in the aggregates. This method can be, and is, rationally used to some extent at the present time. Some of the objections to its use are important, such as the practical difficulties of accurately measuring voids, the many conditions as moisture, settlement of aggregate, compactness, etc., which affect the voids, and the knowledge that after all it is not the voids in the aggregate which determines the quality of the concrete as much as it

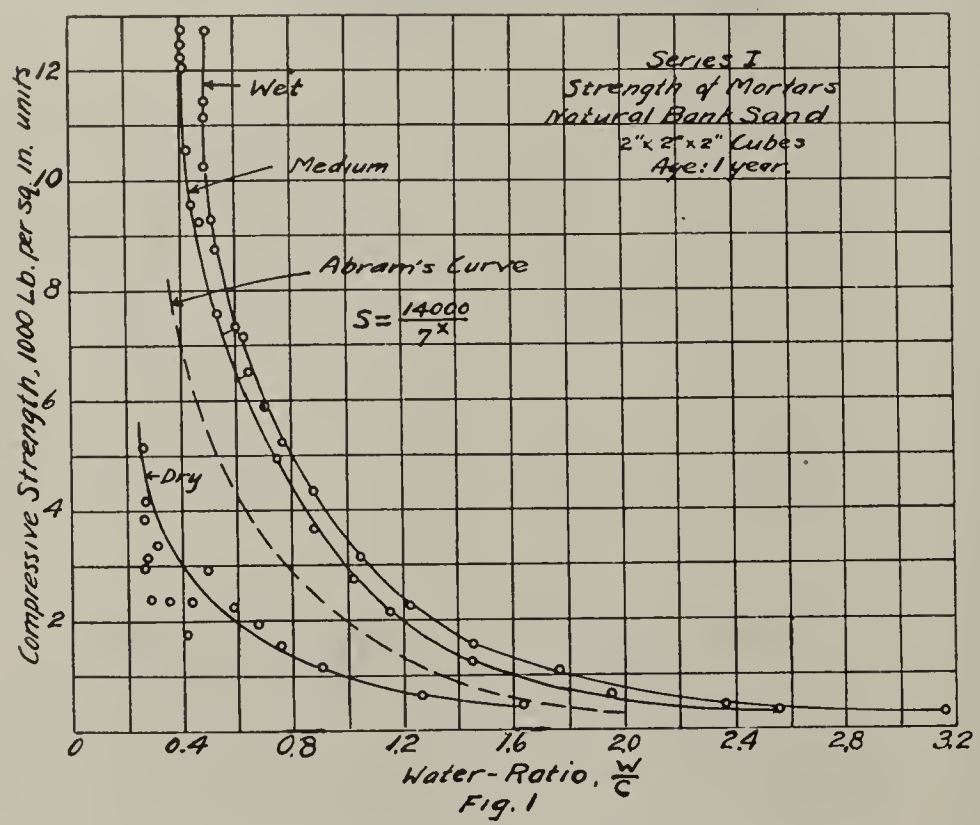


Fig. 1

is the lack of voids or "density" in the mortar or concrete produced.

The "density" theory of proportioning concrete is based upon the idea that just two fundamental factors determine the strength of concrete. One is the actual volume of hard particles in the mass ("density"), and the other is the extent to which they are glued or cemented together. The well known "parabolic" relation of cement and aggregate sizes, first reported by Fuller and Thompson in Trans. Am. Soc. C.E. Vol. 59, is founded upon the principle of producing workable concrete of "maximum density." The writer has never seen results of tests of concrete which disprove the fact that concrete of maximum density is also of the greatest strength for any given proportion of cement. However, density determinations are laborious and impractical. The range in "densities" for commercial mortars and concretes is small so that careful and accurate methods must be employed to obtain usable results.

In the desire for a practical, usable and rapid method of proportioning concrete, and one which would also be founded upon correct principles, there have recently been reported two methods of somewhat unique char-

[1] Design of Concrete Mixtures by Duff A. Abrams. Bulletin No. 1 Structural Materials Research Laboratory, Lewis Institute, Chicago.

[2] "Proportioning the Materials of Mortars and Concretes by the Surface Areas of Aggregates" by L. N. Edwards, Ottawa, Can., Proc. Amer. Soc. for Testing Materials, 1918.

acteristics. The first of these is the "fineness modulus" method of designing concrete mixtures[1]; the second is the surface area method of design.[2]

In the former method, which is founded upon the results of a large number of tests, emphasis is placed on the fact that the quantity of water in the concrete is the controlling factor and that, therefore, the problem of designing concrete mixtures resolves itself into one of determining methods of producing a workable concrete with a minimum quantity of cement and a given water-ratio (ratio of volume of water to volume of cement assuming cement to weigh 94 pounds per cubic foot). "The methods which secure the best grading of aggregates and the use of the driest workable concrete, are thus seen to be only devices which enable us to accomplish the above mentioned results." The amount of water to be used is made a function of

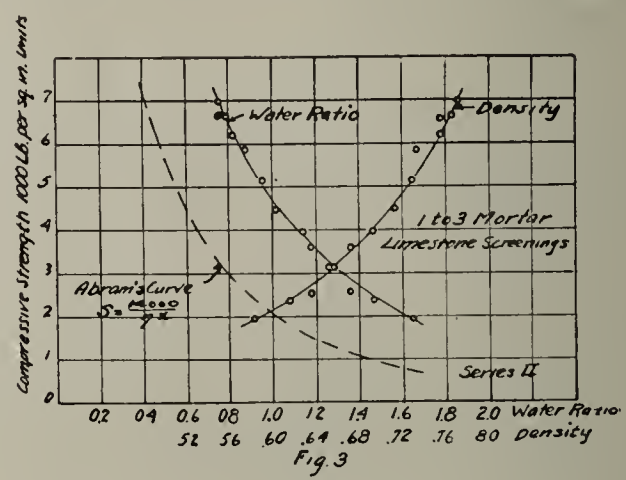


Fig. 3

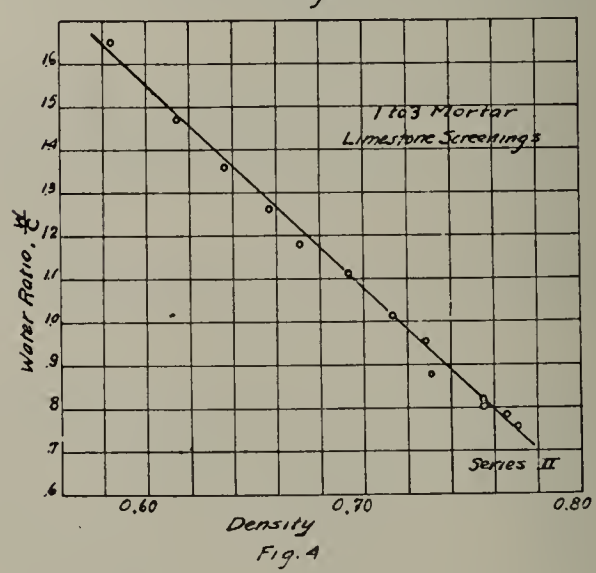


Fig. 4

the normal consistency of the cement and the "fineness modulus" of the aggregate.

The fineness modulus furnishes a method of measuring the size and grading of aggregates. For standardization and uniformity the Tyler standard sieves are used, in which each sieve has a clear opening just double that of the preceding one. The fineness modulus is the sum of the percentages of material coarser than the various given sieves, divided by 100.

The surface area method is based upon the fact that the amount of cement and water required to produce a concrete of a given strength, is a function of the total surface area of all the particles of aggregate. The amount of water to be used is made a function of the normal consistency of the cement and the surface area of the aggregatee. The problem then is to first determine the sieve analysis of the aggregate and, by means of tables or diagrams giving the surface areas of different sizes, to proportion the weight of cement per desired surface area of aggregate. Sand and gravel particles are assumed to be spherical in shape, and

crushed aggregates to be partly cubical and partly parallelepipedal.

The writer has recently finished some tests of cement mortars of various kinds made up about two years ago in the Laboratory for Testing Materials, Purdue University. For purposes of additional information and illustration, certain characteristics of these tests are here given which are entirely apart from the purposes of the tests when they were started.

The three series of tests are as follows:

Series I—Strength of Mortars of sand and limestone screenings with varying proportions of cement, and at three degrees of wetness or consistency. The sand and screenings were of the same sieve analysis, as follows:

Size	Per cent by weight	Size	Per cent by weight
0–100 mesh	2.0	0–20 mesh	40.0
0– 80 "	4.0	0–16 "	50.0
0– 40 "	20.0	0– 8 "	72.0
0– 30 "	35.0	0– 4 "	100.0

Series II—Determination of the effect of fine dust in limestone screenings. (Dust is considered as particles smaller than a No. 100 mesh sieve).

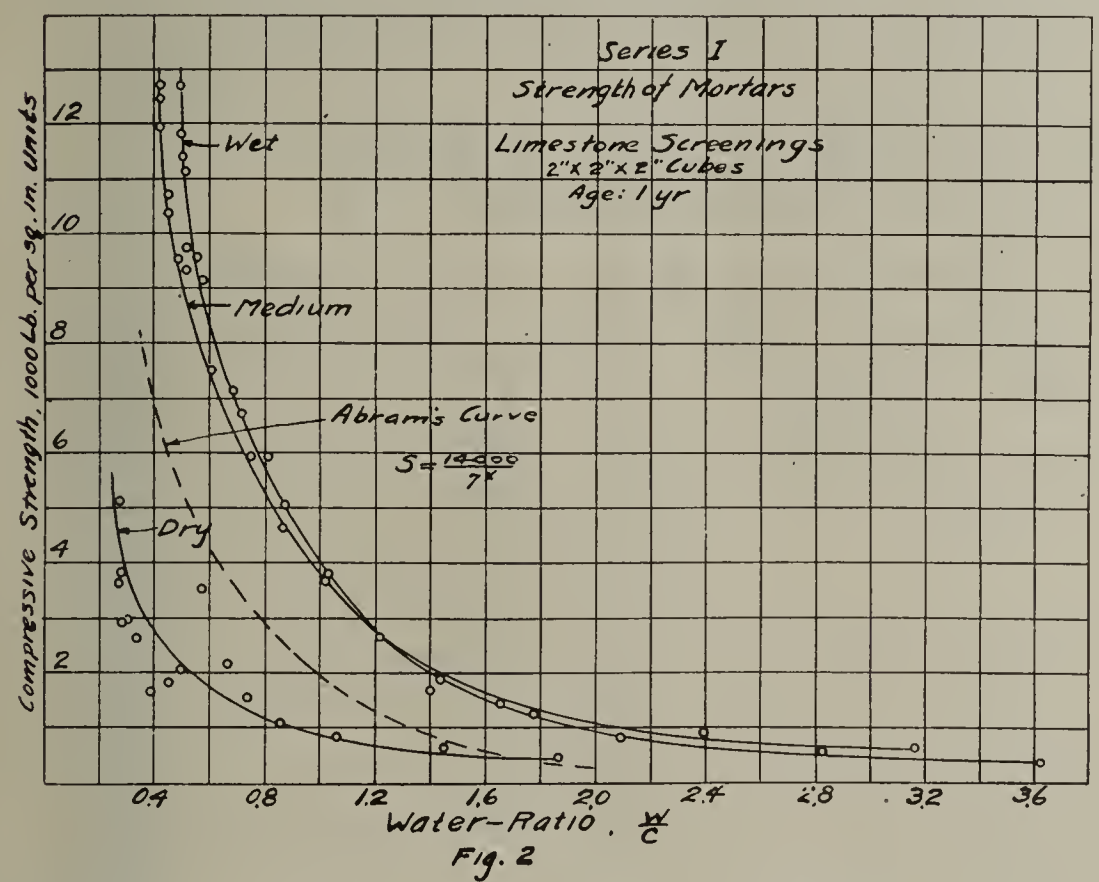


Fig. 2

A partial sieve analysis of the different mixtures is as follows.

PER CENT BY WEIGHT COARSER THAN THE FOLLOWING SIEVES.

Batch No.	100	30	20	8	4
1	0.0	0.0	0.0	0.0	0.0
2	15.0	14.0	13.2	9.7	0.0
3	25.0	23.3	22.1	1.0	0.0
4	35.0	32.8	31.1	22.4	0.0
5	45.0	42.0	39.8	29.0	0.0
6	55.0	51.2	48.6	35.1	0.0
7	65.0	60.7	57.5	41.8	0.0
8	70.0	65.3	61.9	44.9	0.0
9	75.0	70.0	66.3	48.1	0.0
10	80.0	74.8	70.8	51.7	0.0
11	85.0	79.2	75.0	54.7	0.0
12	90.0	84.0	79.5	58.0	0.0
13	95.0	88.7	84.0	61.0	0.0
14	97.5	91.0	86.3	62.8	0.0

Series III—A study of the relation between "density" and strength, using three different graded sands and screenings in a rich, a medium, and a lean mortar.

The proportions used were 1 to 1⅛, 1 to 3, and 1 to 6 by weight. The different gradings were as follows:

Size	PER CENT BY WEIGHT Fine	Medium	Coarse (uniformly graded)
0–100 mesh[3]	9.0	5.0	2.2
0– 30 "	55.0	35.0	8.8
0– 16 "	75.0	50.0	16.8
0– 8 "	90.0	72.0	37.0
0– 4 "	100.0	100.0	100.0

Series No. I Figures 1 and 2, serves as a means of studying the strength of concrete in connection with the "water-cement ratio." It should be noted that when these test specimens were made no attention was paid to water-ratio as such, but extreme care was taken to make all mortars in the same class of the same degree of wetness or consistency, as judged by the eye. The concordance in form with Abram's curve is to be noted. In the case of the writer's results, the variation in water-ratio is caused entirely by varying the amount of cement, the aggregate being constant in all cases.

Series II, Fig. 3, affords a means of illustrating the changes in water-ratio by keeping the amount of cement constant and varying the sizes of the aggregate. In this case the change is effected by varying the amount of material finer than a No. 100 mesh sieve. The concordance in form with Abram's curve is here also to be noted. It should be stated that the constants, in the equation for strength and water-ratio curves, are variable for different conditions of cement quality, age, curing conditions, etc. Figs. 3 and 4, also, show the variation of strength with density and that for the conditions of this series, there is a straight-line relation between water-ratio and density. Figs. 5 and 6 show that, for this series, both the fineness modules and the surface area methods are fairly accurately indicative of the compressive strength and that they also bear a straight-line relation to each other.

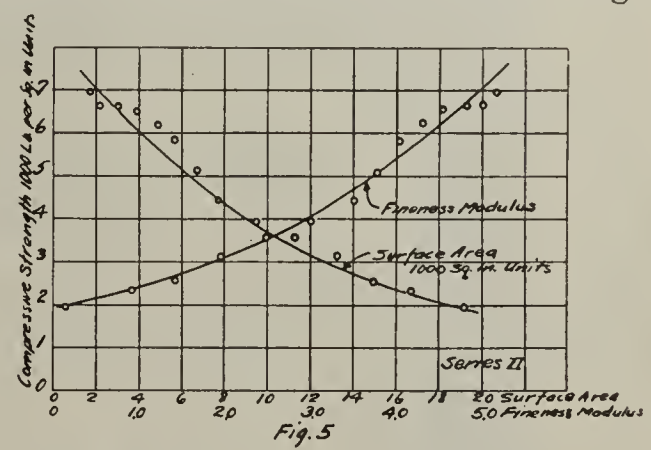


Fig. 5

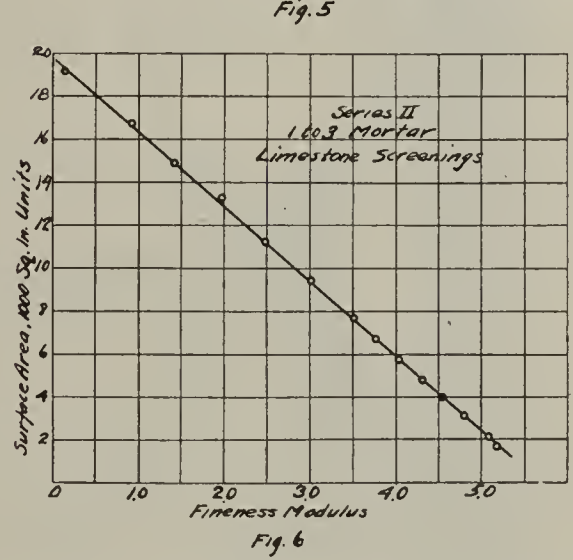


Fig. 6

Series III illustrates a change in water-ratio as effected both by a change in the amount of cement, and by a change in the gradation of the aggregate. Here again water-ratio and density seem to bear a straight line relation to each other for the same proportion of

cement. Figs. 8 and 9, for this series, seem to indicate a fixed relation between fineness modulus and density, suface area and density, and also between fineness modulus and surface area. The strength tests of this series have not as yete been made.

The results of the foregoing tests, while not at all conclusive on account of their non-comprehensiveness, are nevertheless somewhat indicative of a relation existing between fineness modulus and surface area, and also of a relation existing between each of these and the "density" of the concrete produced. It might also seem that the very definite effect of the water content on the strength of mortars and concretes, is not on account of the presence of the water itself as much as on account of the changes in the density of the mass caused by the presence of the water. The writer is at present engaged in studying the properties of mortars and concretes in the commercial range of consistencies and gradings, to see if such relations do not exist.

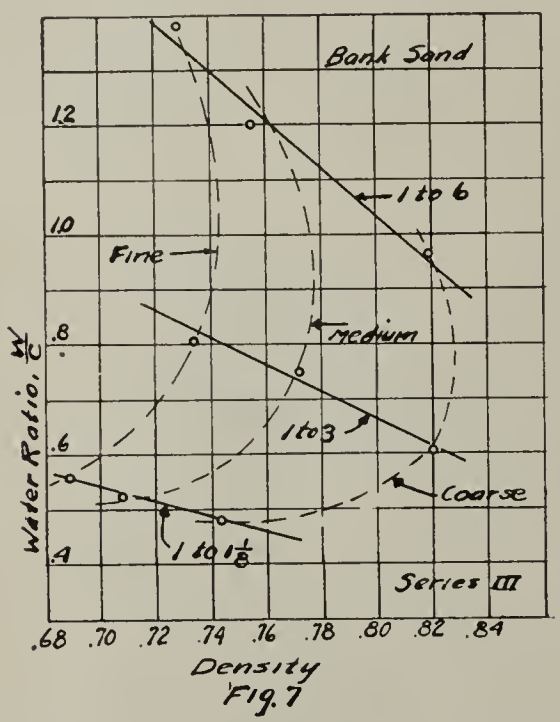


Fig. 7

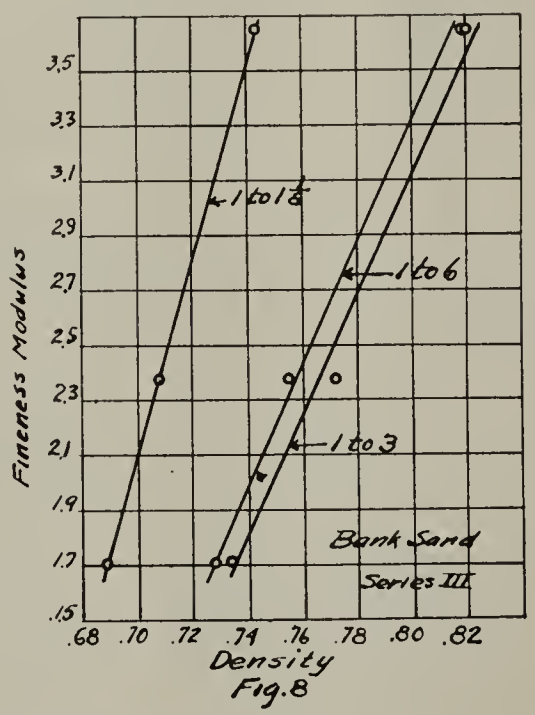


Fig. 8

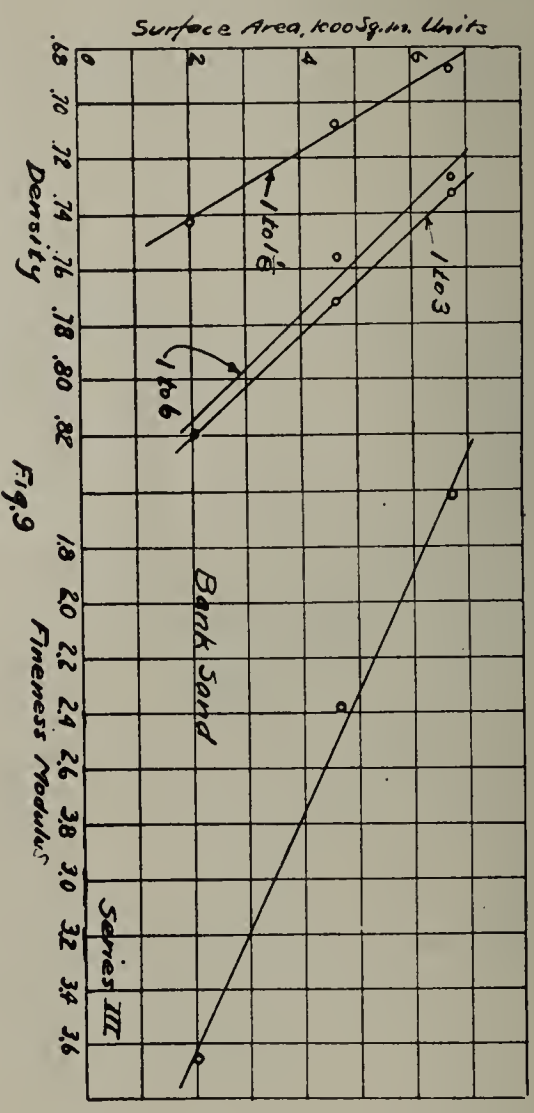


Fig. 9

Both methods of proportioning are to be commended in several important points. Both very definitely fix the amount of water to be used for the best results with the cement and aggregates at hand. Both involve the use of a screen analysis of the aggregate, —a determination which is simple, accurate and practical. The standard set of sieves used in the fineness modulus method would seem to be a step in the right direction toward the development of a uniform specification for aggregates and the methods of combining them. Both methods would promote the use of a greater variety of our natural materials than do our present specifications.

Book Reviews

Concrete Houses—How They Were Built. Edited by Harvey Whipple, Editor of Concrete. 215 pp. 9 by 12 ins. Concrete-Cement Age Publishing Co., Detroit, Mich.

The title page announces that the book is "Compiled from *Concrete* in response to a demand greater than could be met with copies of house building numbers of that magazine."

Here is an excellent compiliation of much that the prospective home builder will want to know; in addition to which it is not without value to the architect and the contractor. Frankly, an argument in behalf of concerete—its claims are urged in a clear cut manner and without subterfuge. The preface makes plain that only good concrete is recommended.

The first section, entitled "Concrete Houses," deals with the aesthetic and miscellaneous advantages of concrete. It points out forcibly that concrete design should not attempt deception by masquerading as stone, brick or frame. When concrete is used the designer should think in terms of concrete, from footing to parapet.

"How will the builder get a Concrete House?" is the title of the second section, in which are presented the economic advantages of concrete.

Following this comes a set of half-tones really convincing of the artistic adaptability of concrete. It includes general views and details of homes in widely separated parts of the country, and also a set of eight "close ups" of finished surfaces of various types as follows: Blocks in two grades of facing mix; fine tooled surface of molded concrete; brushed and acid washed surface of mica crystals; white stucco; dry dash stucco with colored aggregates; coarse tooled surface; brushed out surfaces of various mixtures.

The fourth section of the book constitutes by far the largest part and consists of a series of articles giving many plans, details, views of finished and unfinished work, description of methods and collections of cost data on single house and group construtcion.

Succeeding headings to brief articles are: "What Shall Be Done About the Surface?" "Burned Clay Inserts," "Mosaic Enrichment and History and Development of Stucco."

Standard practice for Portland concrete stucco as recommende by the American Concrete Institute is given in full.

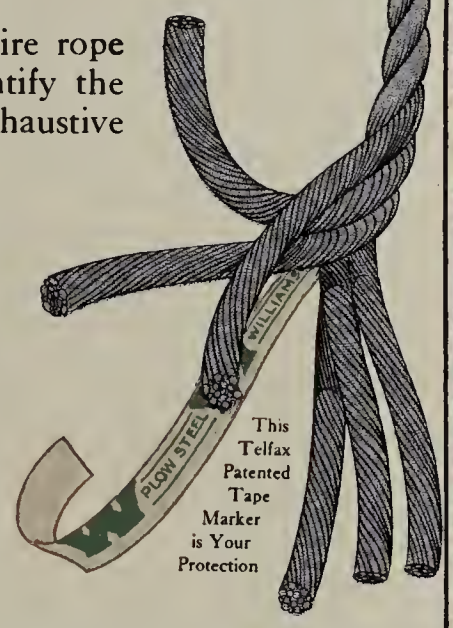
The final section is a collection of articles by seven men and women reciting their actual experiences in living in concrete houses.

WITH THEIR PATENTED TELFAX TAPE MARKER

"WILLIAMSPORT"

Reveals to you the Greatest Advancement of all times in the making of Wire Rope

—and settles forever today's greatest problem in the wire rope industry, by making it possible for anyone to identify the various grades of Williamsport wire rope without an exhaustive and expensive laboratory test.



This Telfax Patented Tape Marker is Your Protection

Beginning November, 1921, every inch of Williamsport Wire Rope contains a distinguishing Telfax Patented Tape Marker, built right through the core of the hemp center, indicating clearly, by distinctive design and color, the various grades of wire rope.

No greater achievement has been accomplished since the beginning of wire rope manufacture. It takes from the industry, as far as Williamsport is concerned, all mystery, all uncertainty, all doubt.

It enables the purchaser to buy with the assurance that their receiving department can tell exactly what has been received, and the superintendent, directly responsible for the lives of his workmen and the efficiency of his equipment, can now see instantly, for himself, that he has received exactly what he has asked for.

Thus Williamsport stands alone in giving to the dealer and user a protection of vital, far reaching importance. And it places upon us a greater responsibility to exercise even greater diligence in keeping the quality worthy of the name it bears.

Never again will you need to feel concerned about the grade of wire rope you get, if you specify and insist upon getting WILLIAMSPORT, Telfax Tape Marked, for substitution cannot take place with Williamsport Wire Rope so marked, no matter

—How many hands it passes through en route.
—How many times it changes reels.
—How careless the warehouseman may be.
—How tricky the seller may be.

If you want to be certain of getting the grade of wire rope you buy—specify "Williamsport". Send today for your Telfax color chart and other literature on this Modern Wire Rope.

WILLIAMSPORT WIRE ROPE COMPANY

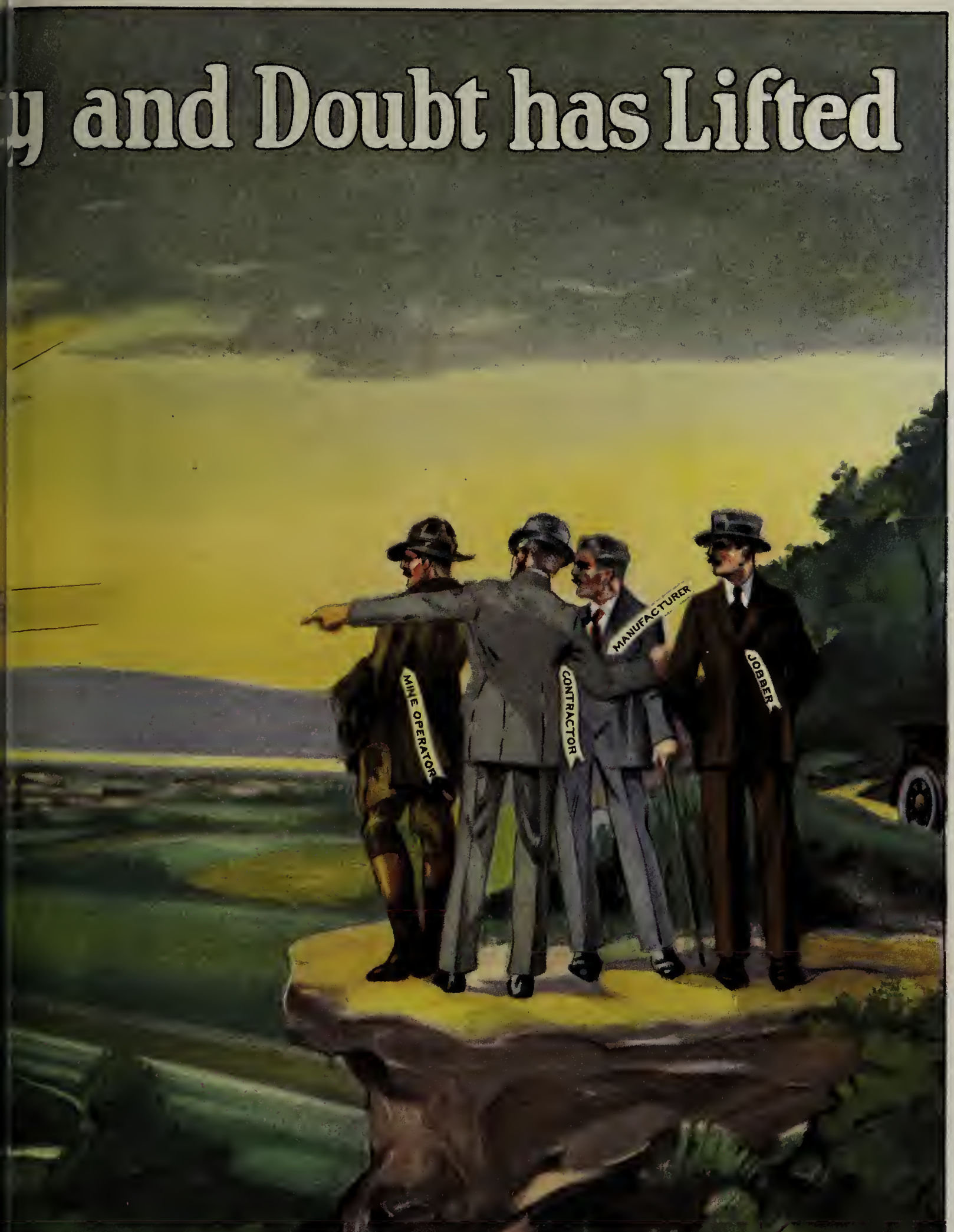
Main Office and Works
Williamsport, Pa.

"accepted as the best"

General Sales Office: Peoples Gas Bldg.
Chicago, Illinois.

TELFAX MARKERS ARE PATENTED IN THE U

y and Doubt has Lifted



IRE ROPE You Buy — if You SPECIFY

SPORT

ker that absolutely prevents Substitution

ID CANADA. FOREIGN PATENTS PENDING

YOU have been GUESSING on the grade of wire rope you have received ever since Wire Rope has been made. Now is the time to STOP IT. Specify WILLIAMSPORT with these Telfax Tape Markers in them — they will absolutely safeguard your purchase.

Write today for your Telfax Color chart and an interesting booklet on Modern Wire Rope

Williamsport Wire Rope Company

GENERAL SALES OFFICES
PEOPLES GAS BUILDING
CHICAGO

PLANT
WILLIAMSPORT
PENNSYLVANIA

WAREHOUSES IN ALL CONVENIENT LOCATIONS IN AMERICA

Effect of Cal in Portland Cement

Result of an investigation by the Bureau of Standards indicates acceleration of setting without reduction of the ultimate strength

With the introduction of more rapid methods of construction and the increasing amount of concrete repair and replacement work, the need for a material for accelerating the hardening of Portland cement has become more pressing, and considerable attention has been given it, notably by the United States Bureau of Standards, which found calcium chloride the most effective of the various substances tested.

Inasmuch, however, as the use of commercial calcium chloride in concrete is attended by difficulties due to its highly hygroscopic nature, Charles Catlett conceived the idea of introducing the salt by means of Cal, which material possesses possibilities even greater than those of calcium chloride since upon decomposition by water, its products are calcium chloride and calcium hydroxide, equivalent to calcium chloride and finely hydrated lime. And since both these materials are now being used separately to advantage in cement mixtures, it was not considered that the use of Cal introduces any novel feature in the making of concrete except the manner in which these materials are added.

Accordingly, an investigation was inaugurated by Mr. Catlett, with the co-operation of the Bureau of Standards, to study the effects of Cal on Portland cement mixtures, the most important object of this being to learn the value of Cal as an accelerator of the hardening of concrete. The following is an abstract of a report recently issued by that bureau as a result of the investigation:

Cal is a dry, white powder obtained by pulverizing the dried or undried product resulting from a mixture of either quicklime or hydrated lime, calcium chloride, and water. It may be handled in much the same way as hydrated lime and has the same general keeping qualities and is much more convenient to handle and use in making concrete than calcium chloride, either fused or in concentrated solution. Cal, upon exposure to the air, gradually takes up carbon dioxide and becomes somewhat damp. Tests show, however, that long exposure does not affect its action as an accelerator of the hardening of Portland cement mixtures.

The setting of normal Portland cement mixture may be hastened to a great extent by the use of Cal. This hastening of the set is particularly desirable in concrete construction requiring a finished surface, and is not objectionable in any type of construction provided the concrete is placed soon after it is gaged with water. It is believed that Cal increases the workability of Portland cement mixtures. No attempt was made, however, to measure the extent of this effect, because up to this time no satisfactory test has been developed for measuring the workability of Portland cement mixtures.

It has been shown that unsound cements may be greatly benefited or made sound by an addition of Cal, which effect was produced in neat pats subjected to the steam test and in mortar test pieces stored in air.

Limited tests show that quick-setting cements, whether fresh or having become quick-setting on ageing, may be made normal by the addition of Cal as used in cement mixtures.

There was no indication that the amount of efflorescence appearing on the surface of cement mixtures exposed to the weather is increased by the use of Cal.

Tests have been made of the effect of Cal on steel reinforcing bars which were embedded in a thin layer of Cal cement mortar and exposed to the weather for 8 months without corrosion; but these tests, while favorable, are insufficient to give assurance that corrosion will not occur under these conditions. Care must therefore be taken in the use of Cal in concrete containing steel reinforcement when the concrete is to be freely exposed to the weather or excessive dampness, though in ordinary building construction no bad effect is believed to result.

Undried Cal mixed with Portland cement causes a greater deterioration of the quality of the cement during storage than ordinarily takes place. Cal, therefore, should be added to the concrete materials during the mixing operation, preferably before the water is added.

Calculations made from tests in which the test pieces were stored in water, damp sand or damp closet, showed that all Portland cement mixtures treated with Cal attained greater strength at the 2-day and 7-day periods than the corresponding untreated mixtures. The increase in the strength of mortar at the 2-day period obtained by the addition of 5 per cent Cal to cement ranged from 40 to 140 per cent. The strength of the treated mortar at 2 days was equal to that of the untreated at 3½ to 8 days.

Treated mortars stored in the laboratory air attained at 2 days strength greater than that of the untreated mortars at 28 days, due to the rapid drying out of the small test pieces and the comparatively slow rate of gain in strength after the 2-day period. This shows Cal to be especially advantageous in cement mixtures which are necessarily subjected to any drying-out action.

The increase in strength produced by 5 per cent Cal in concrete mixtures at the 2-day period ranged from 52 per cent to 135 per cent, and the strength of the treated concrete at this 2-day period equaled that of the untreated at from 3 to 4½ days. This represents a saving, on an average, of half the time in operations dependent on the strength of the concrete at early periods. The effect of the air storage in the concrete tests was lessened in degree, owing to the high relative humidity which existed throughout the storage period.

This increase in strength resulting from an addition of 5 per cent Cal does not represent the maximum which can be obtained except in very rich mixes. As much as 15 per cent Cal was used in mortar tests, giving an increase of 220 per cent at the 2-day period.

The general effect of Cal on Portland cement is the same as might be expected from equivalent amounts of hydrated lime and calcium chloride, and the 3-year tests by the Bureau of Standards on concrete gaged with a solution of calcium chloride are sufficient grounds for the belief that Cal will not in any way affect the ultimate strength and integrity of Portland cement concrete.

Concrete Park Bench

The Art Concrete Works, Pasadena, Calif., own patents on various products including a portable knock down type of concrete wood park bench and they are now selling molds to anyone for making this bench.

Loading and Screening with a Scoop Conveyo r

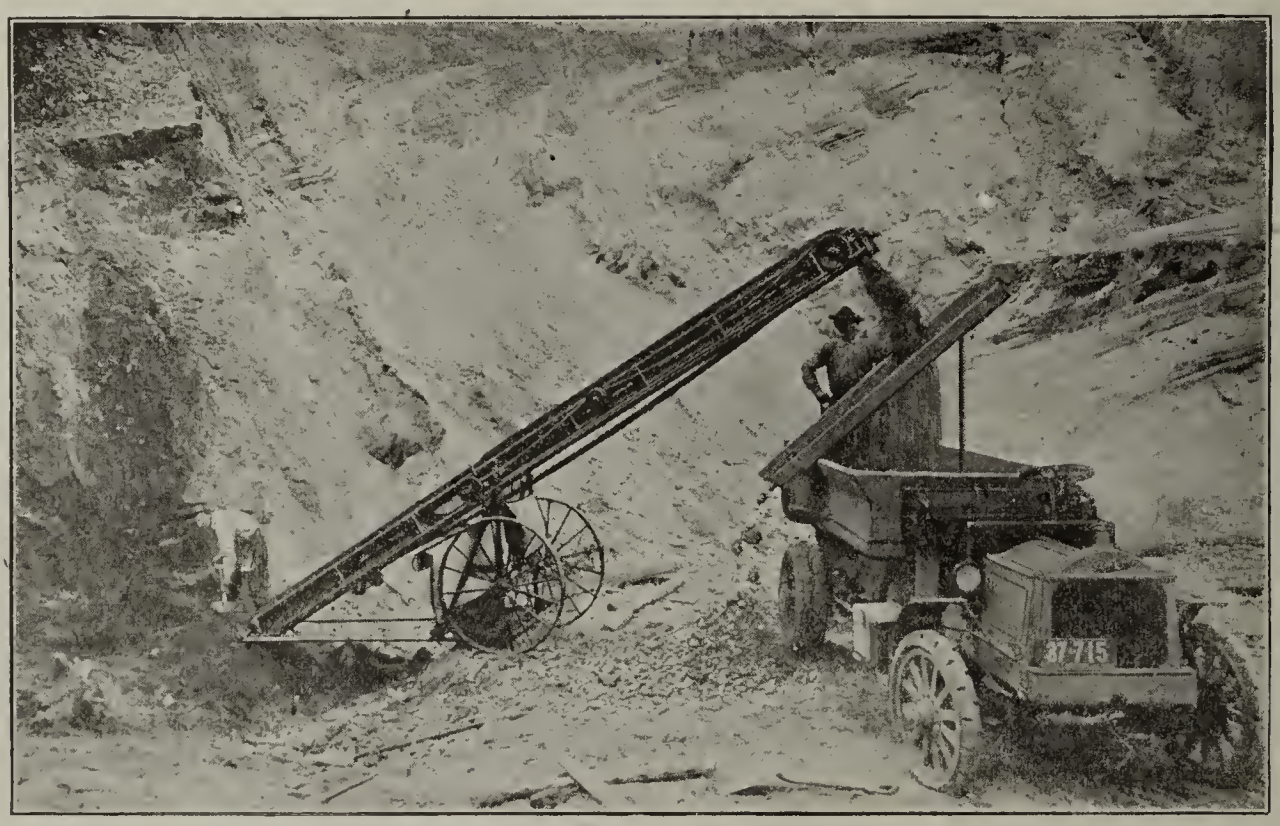
The accompanying illustration shows a novel Scoop Conceyor installation at the sand pit of Somes & Sons, Wyoming, Pa.

Mr. Somers had been experiencing much trouble and expense in screening his sand and being a resourceful man it occurred to him that an arrangement could be made with his Scoop Conveyor so as to screen at the same time as loading.

The accompanying arrangement ensued. The screen was placed in the truck being supported in the truck by a pole and on the edge of the truck by a small block of wood.

The 24-foot Scoop Conveyor was then placed so that the material, when discharged, would fall near the top of the screen. The screen being set at the proper angle the large lumps rolled off out of the truck while the fines fell through.

With this arrangement Mr. Somers is loading and screening 5 tons of sand in 7 minutes. In addition to the money saved on the loading operation the additional revenue obtained by delivering screened sand made this an investment that soon paid for itself. Prices and catalogs concerning Scoop Conveyor will be sent to interested parties by writing Cement & Engineering News, 22 Quincy St., Chicago.



Core Drilling

What is not so generally known is that the Sullivan Machinery Co., 418 Gas Bldg., Chicago, is the oldest and largest firm of core boring contractors in existence. Back in the "eighties," the Diamond Prospecting Company of Chicago became the leading core drill contractor in America. It employed Sullivan Diamond Drills. In 1892 it was merged with the firm manufacturing these tools, and its president became the president of the new "Sullivan Machinery Company."

The men that built up this early drilling organization are still in charge of the company's department of contract core drilling. Their experience, and the experience of the large corps of skilled operators and superintendents which they have trained and maintained for the past thirty-six years ,embraces a knowledge of geological formations and drilling conditions in all parts of the United States, Canada, Mexico and many countries abroad. Millions of feet of cores have been secured for clients, constituting an accurate, permanent and indisputable record of the strata and deposits at the sites investigated.

Sullivan Reliability

The importance of employing a firm of absolute reliability and of the highest possible standing cannot be overestimated. The accuracy of the process, the efficiency of the tools used, the skill of the operators, and the responsibility of the contractor behind the drills and men should be considered most carefully. Engineers, cement manufacturers, crushed stone and lime producers, mine owners and mineral land purchasers everywhere accept core records, if secured by this company, as final authority as to location of rock strata or existence and character of veins and ore bodies, whether these cores were recovered last week, last year or last century. The Sullivan Machinery Company stands back of Sullivan records absolutely.

Core drilling on the site of the limestone property of the Western States Portland Cement Company near Buffalo, Iowa, were made by the Sullivan Machinery Company and the successful results of the drilling tests has determined the cement company to build a cement plant on the property.

Steam Shovel Mounted on Rubber-Tired Wheels

The Osgood Co., of Marion, Ohio, is now prepared to equip its Model 18, ¾-yd. traction revolving steam shovel with solid rubber tires. The purpose is to make a unit which can be moved over city pavements at considerable speed in going from job to job. The gears for self-propulsion can be disengaged so that the unit can be towed rapidly.

The tires are 40 in. in diameter and 14 in. wide, with ribbed treads. They are mounted on steel rims which are pressed on the regular 35 in.-diameter by 16 in.-face cast-steel wheels. This arrangement permits removal of the tires when desired. Cleats can then be attached to the rear wheels.

The Manufacture of Concrete Pipes by the "Hume" Centrifugal Process

By W. WOLSTENHOLME,
From The Journal of the South African Institution of Engineers, May, 1920.

Discarded wire ropes are generally used for the purpose of reinforcement. These ropes are carefully selected.

The ropes are cut in suitable lengths and annealed. The annealing removes the grease and makes the wire ductile so that it can conveniently be made up in reinforcing cages. The rope is next unstranded and the individual wires wound on the spools and placed on jennies behind the reinforcement weaving machines. The reinforcements weaving machines are fitted with collapsible drums and the wire is wound on to these drums first spirally and

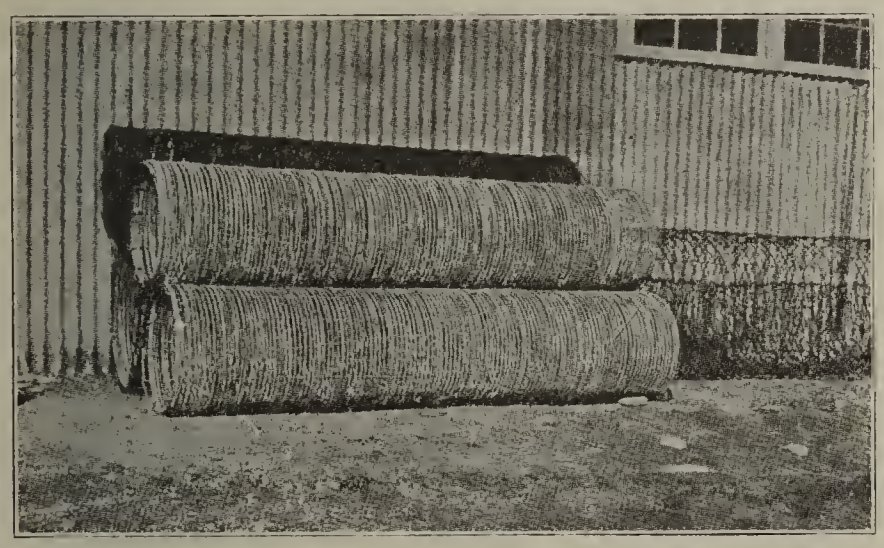


Fig. 1.—Reinforcement for 18-in. pipes, 180-lb. pressure.

then longitudinally. For high pressure pipes it may be necessary to have several layers of spiral wire and several layers of longitudinal wires. See Fig. 1. These layers are pitched automatically so that each falls between the preceding layer. For low pressure pipes it is usual to arrange the wire so that two spiral layers and one set of longitudinal wires are sufficient. When the case is completed the drum is collapsed and the cage withdrawn. The cage is then placed in the pipe mould.

The pipe moulds are usually made of light steel sheet, galvanized preferably, with cast iron end rings. The end rings serve a treble purpose as they secure the steel casing, form the thickness of the wall of the finished pipe and provide the running treads which come in frictional contact with the revolving discs of the moulding machine. See Fig. 2.

The moulding machines are of simple design. The frame consists of two longitudinal girders in which are mounted the bearings and shafts. Discs are keyed on the end of each shaft suitably spaced to receive the end rings of the pipe mould. Variable speeds are obtained by long cone pulleys, by stop pulleys or by variable speed motors.

The driving power operate sthe first disc shaft only and each succeeding disc shaft is operated by the frictional contact of the pipe mould. On the small moulding machine six pipes, and on the larger machines four pipes are made at the same time. (Fig 3.)

The original machines were obtained from Australia. These machines were arranged to make three pipes at one time up to 15 in. diameter and two pipes at one time in the larger sizes. In re-designing the machines to make six pipes at one time on the small machines, and four pipes at one time on the larger machines. The results have been entirely satisfactory.

The pipe moulds are placed in position on the discs and the moulding machine then commences to revolve slowly. The concrete is thrown into the moulds until the required amount is furnished. The centrifugal force spreads the concrete evenly through the length of the mould and the operator can see when sufficient has been supplied. The machine is then speeded up and the water in the concrete rapidly extracted by the centrifugal force. This water accumulates on the inner surface of the pipes and after a short time the machine is stopped, the removable water rings which are fitted into the mould ends removed, and the water allowed to run out. The machine is again started up and run at high speed and the pipe dried out. If an exceptionally smooth internal surface is desired, a polishing bar is firmly applied to the surface of the concrete. The bar usually consists of a polished piece of steel pipe and is pressed down on to the concrete.

Another method of smoothing the surface is by the insertion of a steel cylinder somewhat smaller in outside diameter than the bore of the concrete pipes. Mounted longitudinally on the surface of the cylinder are a series of sheet strips which act as trowels. These trowels come in contact with the concrete and tend to smooth the surface. The cylinder may be revolved in the opposite direction to the pipe or may be stationary.

The time required to complete a batch of pipes varies with the size of the pipe and the quality of concrete used. Generally speaking, six 4-in. or 6-in. diameter pipes can be completed in 8 to 9 minutes, while four 15-in, or 18-in. diameter pipes require about 15 minutes. Pipes of 48-in. or 60-in. diameter can be finished in about 20 minutes.

Pipes up to 15 in. diameter are usually made in 6 ft. 0 in. lengths, and 19 in. to 72 in. diameter in 8 ft. 0 in. lengths. These lengths may be subdivided into shorter lengths by placing a steel dividing ring in the mould.

When the pipes are completed on the moulding machine they are carefully rolled into the steaming cham-

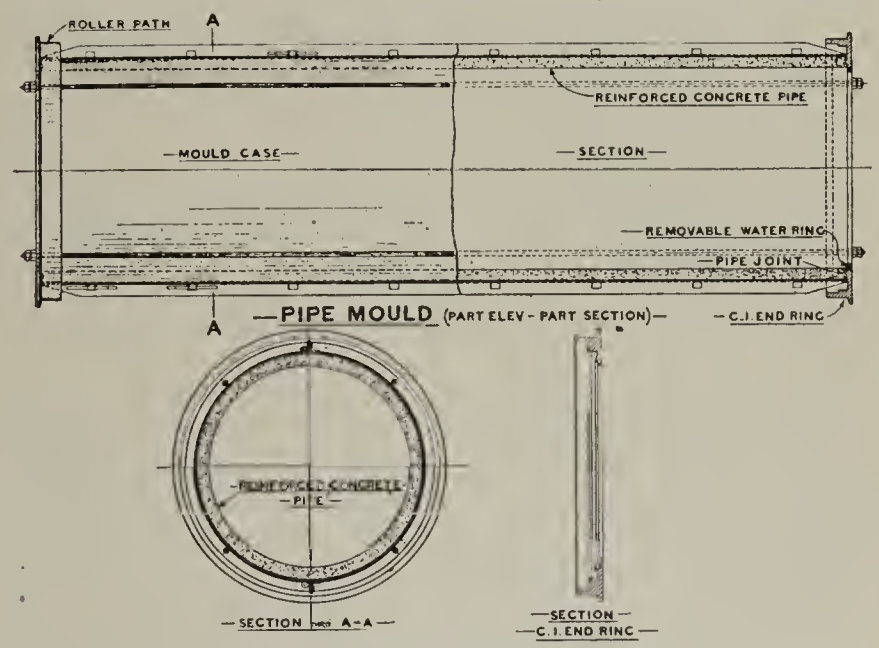


Fig. 2.—Standard pipe mold.

ber and left in a temperature of about 200° F. for 12 hours.

They are then removed from the moulds and placed overhead in water for at least one week if high pressure pipes, and for a shorter period if for low pressure or drainage purposes. The pipes are then stacked for a further period, at least four weeks, before delivery to purchaser.

Pipe collars are made in exactly the same manner as pipes, excepting that thin steel division or parting plates

are placed in the mould at intervals of 6 in. or 9 in.

As already mentioned, at the factory we use large quantities of steel wire obtained from selected wire ropes, for the reinforcement. For very high pressures new steel wire of high tensile strength may be used, while for the highest pressure a sheet steel liner is embedded in the concrete. Using the latter method of reinforcement a test pressure of 750 lb. per square inch has been obtained.

We find, from experience, that for high pressure pipes a mixture of 2 parts washed and screened sand and 1 part cement gives the best results, while for low pressure pipes 2 parts of crushed waste rock (from the mines), 2 parts sand and 1 part cement gives good results.

Tests and Working Results.—A certain percentage of all pressure pipes are tested regularly. With small diameter pipes, say, up to 9 in., we regularly get up to 300 or 350 lb. per square inch. With large diameters, say, 18 in. and 24 in., we have tested up to 210 lb. per square inch. These figures are obtained on pipes with reinforcements made from the wire taken from discarded wire ropes.

I might mention here that the quality of reinforcement is carefully calculated and arranged so that at working pressure the wire is never stresser higher than one-fourth of the elastic limit of the wire used. Generally, a lower stress is taken so as to have ample margin to resist shock loads due to water hammer, etc. The strength of concrete in tension is not taken into account, though as a matter of fact, such strength adds further to the safety of the pipe. In testing concrete pipes made by the "Hume" process and in actual practice under working conditions, it is found that when an excessive overload is applied the pipes sweat

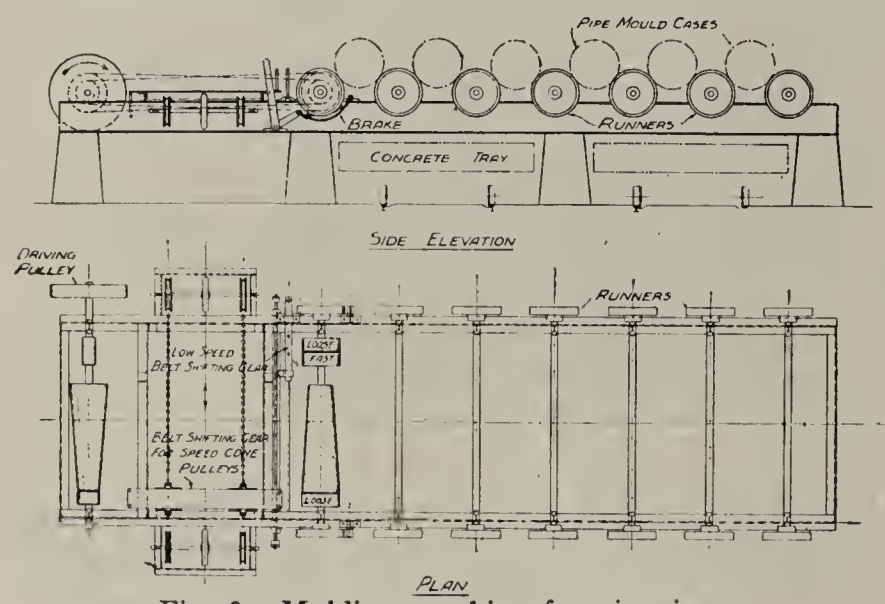


Fig. 3.—Molding machine for six pipes.

heavily and so release the excessive pressure. The pipe may eventually develop slight cracks, but will not burst. Under the worst circumstances the pipes will carry water again when pressure is back to normal, generally without leakage, but in any case they will carry water until such time as defective pipes can be replaced.

We have an 18-in. diameter pipe at the factory made for 100 lb. per square-inch pressure. We tested with a handpump to see what this pipe would carry. At 210 lb. it sweated heavily and it was not possible to raise this pressure. Slight longitudinal cracks were visible under the overload test. At 100 lb. pressure the pipe is tight today, although it is six months since the overload test was made.

The joints are made in a simple and efficient manner. A collar reinforced in the same manner as the pipe is slipped over the joint. The space between the outside of pipe and inside of collar is rammed up with a mixture of 1 sand and 1 cement. For high pressure joints, in addition to the ramming, a plastic substance of special mixture is filled into a cavity formed in each pipe end. The pipe ends are tightly butted together with the plastic material completely filling the cavity. When the pressure is applied inside of the pipe any leakage of water at the joints tends to displace the plastic and forces it more tightly into position in the cavity and so prevents the leakage reaching the ramming in the collar. The plastic is of peculiar

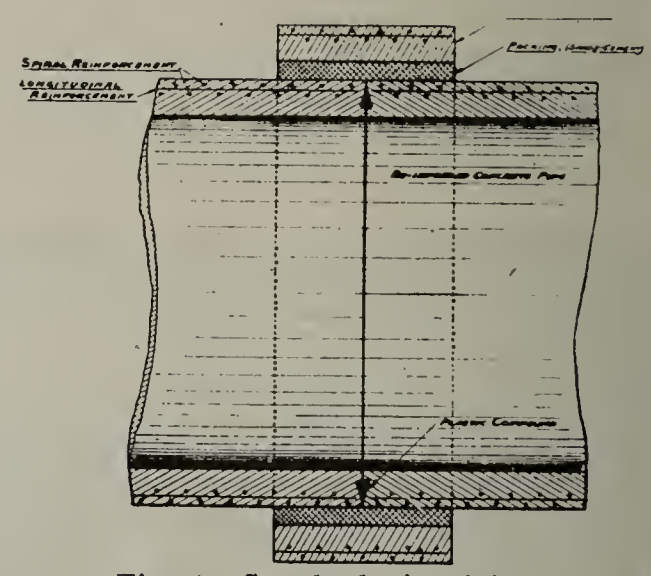


Fig. 4.—Standard pipe joint.

composition and retains its plastic state for many years.

Other methods of jointing may be and have been used with success. For instance, the ordinary Kimberley collar caulked with lead has been used in many cases; faucet and socket joints have been used, but results are unsatisfactory for many reasons. The joints are considerably stronger than the pipe as the reinforced collar binds the pipe end all around.

In addition to the use of concrete pipes for conveying high and low pressure water the centrifugal process has made it impossible to make concrete pipes sufficiently dense to carry sewage without the least risk. The centrifugal process had also made it possible to make exceedingly thin pipes. Such pipes have been supplied for carrying air for ventilation purposes underground on the mines. Pipes of 12 in. to 18 in. diameter are regularly made ¼ in. to ⅜ in. thick. These pipes are reinforced with ordinary wire netting of 1½-in. or 2-in. mesh. These pipes are also in use as smokestacks. Thousands of feet are in use carrying electric cables for post office telephone service, etc.

Then again, special pipes are made for lining boreholes, wells, etc. Culvert pipes have been supplied in large quantities and are rapidly replacing the "box" form built in situ. Tanks for the conservation of rainwater and for the storage of mealies and ensilage are regularly made.

Steel or iron pipes, damaged by corrosion, are lined with concrete, the mixture being spun in centrifugally.

One of the latest uses for concrete pipes (used as tanks) is for the storage of wines, spirits and beers. The centrifugal process makes it possible economically to use concrete for these purposes as the receptacles can be made light in weight and of great strength.

Road Guard Rail Timbers Mounted on Concrete Pipe

System Adopted for Highways at Spokane, Wash., is Cheap, Strong, Readily Visible and Safe.

By A. D. Butler
City Engineer, Spokane, Wash.

In these days when there is an ever increasing number of automobile accidents, the engineer who has to do with the construction of highways, streets or boulevards, every year finds it more necessary to protect the edges of his fills or side-hill work by a suitable guard rail, one which is required to render an entirely different service from the guard rail or handrail of several years ago.

What is the problem of design in such rails? First there is the matter of cost. They must be as cheaply constructed as possible. And in the matter of first cost can be considered the length of time before they must be removed; or, in other words, the cost per year.

Second, the rail must be strong. While it is impracticable to build a structure that will withstand the shock of a heavy automobile driven at a high rate of speed. or that of a heavy truck, yet it should be strong enough so that after it has been run into by an automobile driven at a reckless rate, the repair man can come out and haul off the remains of the machine, rather than send for the maintenance crew to repair the guard rail.

Third, it must be borne in mind that, in the vast majority of cases the machine that collides with the rail will do so almost parallel to the direction in which the rail is running; so, if possible, a rail should be used of such height as to have the tendency, when collided with in this manner, to permit the wheel to slide along it and crowd the machine back into the road, rather than to have any projecting posts to catch the wheel or hub and

Concrete pipe used as standards for guard rail.

thus wreck the machine or destroy the guard rail.

The fourth requirement is that the rail should be readily seen both in the daytime and at night. With these fundamental requirements in mind, the writer has adopted the following form of guard rail with considerable success.

The posts consist of machine-made concrete pipe, made by the Spokane Concrete Pipe Co. with a Hammond machine. These pipes are 3 ft. long and 10 in. in diameter. A V-shaped templet is used in the bottom of the mold, such that when the pipe is made, an 8 x 8-in. timber will fit corner wise in this V-shaped notch. These pipes are then filled with concrete and a bolt anchored in the center of the V, extending outward far enough to pass thru an 8 x 8-in. timber corner-wise. The holes for the posts are dug, the posts stood in place and the timbers, after

Guard rail in place on road in Spokane.

having been bored, are fitted into the V of the posts with the bolt extending diagonally through the timber. The posts are then lined up, filled and tamped around. The rail should be of such a height as to be just below the hub of an automobile wheel. In this way it furnishes the maximum protection to the machine with the least danger of catching the hub and wrecking the auto.

On a recent job, 1,600 ft. of this guard rail, constructed by the Street Department under Leonard Funk, commissioner of public works of Spokane, cost a total of $947.77, including the cost of all material and labor in finishing and painting. This made the rail cost 59c. per ft. The items of cost were as follows:

1,600 lin. ft. 8x8-in. timber	$361.12
202 posts	303.00
Cement	20.90
Paint	16.58
Washers	3.10
Paint Brushes	6.17
Bolts	34.00
Labor	202.90

The following formula for whitewash has been used and gives very good satisfaction:

Half a bushel of unslacked lime; slack with warm water; cover it during the process to keep the steam; strain the liquid through a fine sieve or strainer; add a peck of salt previously dissolved in warm water; 3 lb. of ground rice, boiled to a thin paste and stir in boiling hot; ½ lb. of Spanish whiting and a pound of glue which has been previously dissolved over a slow fire, and add 5 gal. of hot water to the mixture; stir well and let stand for a few days; cover up from dirt. It should be put on hot. One pint of the mixaure properly applied will cover a square yard. Small brushes are best.

News of the Cement Mills

The men connected with the National Portland Cement company who will erect a new mill at Mt. Pleasant, Mich., have had experience in the manufacture of Portland cement and having devoted considerable time to the organization of their company will doubtless carry the project through to completion.

The vice-president and general manager, H. C. Shields, was born August 20, 1871, at Richmond, Va. He was with the Dexter Portland Cement company as assistant superintendent in 1900 and then with the North Hampton Portland Cement company as general superintendent and engineer of construction. He was in charge of the designing and building of a 6,000 barrel plant for the Atlantic Portland Cement company.

About this time Thomas G. Edison became interested in the development of the cement industry and Mr. Shields was engaged as general manager of the quarry and crushing operations of the Edison Portland cement company and had charge of their railroad construction, machinery installation, and sales.

During these activities he introduced many improvements over the processes then in use. He gained recognition as being a practical cement manufacturer and was made vice-president and general manager of the Marengo Portland Cement company.

Col. Fuller of the Fuller Engineering company, Allentown, Penn., sent him to Canada, where he remained for four years in charge of cement plant operations. During this period Mr. Shields had the opportunity of visiting every cement plant in Canada; and F. B. Kilbourne, general superintendent of the 14 plants of the Canada Portland Cement Company, Ltd., of Montreal, says that Mr. Shields has a very wide knowledge of the most recent methods in the manufacturing of cement and that he does not know of any person more competent to design, erect ,and operate an up-to-date plant.

His work was so satisfactory in Canada that he was put in charge of the Chicago office of the Fuller Engineering company as western district engineer.

Other companies with which he has been associated are the Union Cement company, Ltd., Owen Sound, Ontario, and the Nebraska Cement company. He was on the board of directors for both of these companies and was vice-president and general manager of the Arkansas Portland Cement company. The general manager of the Missouri and the St. Louis Portland Cement companies, D. N. Armstrong, has been familiar with Mr. Shields' work in the southern states and says that he has an intimate knowledge of the industry and is well known favorably to operators and executives all over the country.

Shortly after Mr. Shields left the Fuller Engineering company, he became consulting engineer for the Peerless Egyptian and American Portland Cement companies. He became interested in the Soper Engineering Company of which he was general manager and remodeled the plants of the Michigan, Wiarton, Marengo, and Wayland Portland cement companies. After completing these operations in 1920, he made extensive changes in the plant of Wolverine Portland Cement company which increased their operating efficiency and reduced their production cost to such a degree that he became recognized as being one of the best cement experts in America.—Mt. Pleasant, Mich., Enterprise.

In view of the fact that the Chinese Republic (Canton Government) has under consideration either the remodeling and extension of the 500-bbl. cement plant, which it now controls, or building a new one of 1,200-bbls. daily capacity, it may be of interest to our readers to know what the present plant consists of. It is operated under the name of the Kwangtung Government Cement Works, Honam, Canton, China, and includes eight stationary kilns of the Dietsch type, utilizing lump coal for fuel. Jaw crushers are used for reducing the limestone, and pebble and ball mills for the raw grinding and finishing departments. The product of the preliminary grinders is briquetted and dried before being charged into the kilns. The process used, however, is obsolete and expensive. A 500-hp. compound steam engine furnishes the power for the plant. H. Y. Tang is superintendent of the works, with Q. S. Shie as chemist.

M. S. Dougherty Co., Philadelphia, Pa., announces that Earl F. Heimpel, M. E., formerly chief engineer of the Edison Portland Cement Co., Stewartsville, N. J., has resigned to enter the sales force of the M. J. Dougherty Co., piping fabricators and engineers of Philadelphia. Mr. Heimpel, who is a graduate of Lehigh University, has had a wide and varied experience in the engineering field and will be located in the home office.

Black Hills Rock Products Co., Rapid City, South Dakota, have opened an eastern office, Indiana Trust Bldg., Indianapolis, Ind. The officers of the company are Charles E. Talkington, Prest., formerly superintendent Indiana State Farm; Fred H. Cutting, vice-prest.; William T. Brown, Secy-Treas., formerly of Washington, Ind.; Dusten Ely, Asst. Secy,-Treas., Madison, Ind., and Rapid City, S. D. The company has over $140,000 in improvements on their 600 acres in the Black Hills in the Western part of South Dakota. They have a completed lime plant, side tracks and switches, structural steel, 2 rotary cement kilns, etc. Additional machinery and equipment are needed, also for the stucco mill, crushed stone and brick and tile plants. $500,000 of stock is now offered at par to provide the needed capital to complete these plants. The capital stock is being increased to $1,500,000 and the company is right in the midst of their financing. The new cement mill will have a capacity of 1,200 to 1,500 barrels per day. Additional units will be added as fast as practicable until a daily capacity of 2,500 to 3,000 barrels is reached and as much more as the demand for cement will justify. Dodge & Heiby, who designed and constructed the Indiana Portland Cement Co. mill at Greencastle, Ind., are the engineers.

Frank P. Jones, has been appointed president of the Canada Cement Co., Montreal. He has been with the Canada Cement Co. since the beginning of 1910, as general manager, later being made a director and still later a vice-president. He was previously associated with the Dominion Iron & Steel Co., starting as sales manager and rising to be general sales agent, and from 1905 to 1910, general manager. Besides his con-

nections with the Cement company, Mr. Jones is president of the Consumers Gas Co., director of the Canadian Bank of Commerce, Montreal Trust Co., and the Ontario Steel Products Co.

Chester J. Pegg, manager, Novella Cement Co., Guatemala, C. A., writes interestingly of the cement making machinery installed in the plant. He first describes the location of the mill, which is in Guatemala, the metropolis and capital of Guatemala, which has a population of 140,000 and lies at an elevation of 5,000 ft.

The property contains a very high grade limestone, clay and volcanic ash called "tuffa," which are all excellent cement materials. We, however, use the volcanic ash in place of the clay, as it is nearer the mill and much easier to handle.

The property contains a magnesium limestone which makes a high grade lime. The company also operates lime kilns and a crushing plant to produce building stone and ballast and fertilizer lime. The fuels used are Mexican crude oil for cement burning and drying, and wood and oil for lime burning.

Wood-burned limes seem to be the most in demand and bring a very high price. Our cement plant is almost entirely a gravity proposition and is operated with very little power and consists of the following equipment:

Two 11 by 22-in. jaw crushers.
One 5 by 55-ft. Bonnott rock dryer.
One 4 by 80-ft. Bonnott tuffa dryer.
Round steel storage tanks for dried rock and tuffa.
One hopper scale for raw mix.
One belt conveyor from mix scales to ball mill hopper.
Two Krupp ball mills for preliminary raw mix.
One 5 by 22-ft. Gates tube mill for raw mix.
One 7 by 90-ft. Ruggles-Coles rotary kiln.
One vertical steel clinker cooler.
Three 30-in. Griffin mills for preliminary clinker grinding.
One clinker and gypsum measuring device.
One 5 by 18-ft. tube mill for finishing clinker.
One double-drum, motor-driven, cableway for carrying volcanic ash from ravine to mill.

Cement is packed in automatic bagging machines recently installed. Quarry stone is loaded by hand and brought to crushers in steel dump cars.

At present our power is bought from a hydro-electric company, but we are developing a hydro-electric property of our own in the mountains where about 2,000 kw. are available.

The plant is individual motor driven with 3-phase, 50-cycle, 1,000-volt induction motors.

Our fuel oil is shipped from Mexico in tank steamers to Puerto Barrios, the Atlantic terminal of the railways, then to Guatemala, in tank cars. The oil and mineral fields of Guatemala have not been opened up yet to any great extent but the prospects are good.

Our gypsum, which is very pure, is brought from the Mexican and Honduras border. The plant only started producing cement in 1918 and it has proved to be the very best quality. The plant now produces about 200,000 bbls. per annum.

The plant is of course complete with auxiliaries, such as conveyors, elevators, oil pumps, air compressors, repair shops and oil burning locomotive for switching.

There is a more or less prevalent impression in some branches of industry that welding is confined to comparatively small operations, and that, while it can be economically employed on ordinary repair work, it can not be used to advantage in reclaiming heavy machinery and ponderous equipment. No notion could be more mistaken, as any one familiar with the welding work done in shipyards, steel mills, large foundries, etc., can testify; but there are still many otherwise well informed and very able men responsible for the upkeep of heavy machinery installations, that do not realize the extent to which their welding shops can be made to solve maintenance problems.

An instance of this kind occurred recently at a large cement plant in the far west. A cast steel ball mill head had been broken in service, and, owing to the great weight of the part and the character of the break, the idea of welding was not even considered in the beginning. Fortunately, one of the Service Engineers of a welding organization dropped in on the Superintendent of the plant about this time, and, learning that operation of this particular unit was temporarily at a standstill pending replacement of the broken head, asked permission to demonstrate how the part could be reclaimed by welding.

The work was done at the plant of the Three Forks Portland Cement Company located at Trident, Montana. It included a weld 9 feet long and varying in thickness from 1¼ to 5", on a steel casting weighing 3,800 pounds.

The job required nineteen hours of continuous welding with two welders relaying. It was necessary to keep the entire shaft in perfect alignment at right angles to the sides, and this was successfully accomplished. The entire operation was eminently satisfactory, and the plant superintendent expressed himself as greatly pleased with the result.

The Iola Cement Mills Traffic Association, in support of its petition with reference to transportation rates on cement in western territory, has filed an extensive brief with the Interstate Commerce Commission recounting at length the reasons it has assigned for the extension of the Scale II basis of rates to include eastern Kansas, eastern Nebraska and southwest Missouri.

The association contends that in order to establish reasonable rates, remove discrimination and prejudice, wipe out violations of the long-and-short haul provision of the Interstate Commerce Act to restore rates to the measure contemplated by the Interstate Commerce Commission in its original decision, plus increases of 2 cents per 10d lbs. under general order 28 of the director general of railroads and 30 per cent under the general rate increases in August, 1920, the scale II territory should be extended as proposed.

The Atlas Portland Cement Company has intervened in opposition to the petition and declares that the evidence introduced is insufficient to warrant extending Scale II territory. The Atlas attorneys declare that the extension suggested would result in the same level of rates on cement throughout Central Freight Association and western trunk line territory and a substantial part of trans-Missouri territory, a condition that does not exist as to class rates or the rates on other commodities. While the primary purpose of the Iola mills is to apply Scale II rates on shipments from their mills at Bonner Springs, in the Kansas gas belt and at Dewey, Okla., to points in Nebraska, and incidentally to points in southeast Missouri, the second purpose of the petitioners, it is declared, is to take away the natural geographical advantages of their competitors.

News of the Concrete Products Factories

A severe fire with no damage—that's what a large crowd of interested builders and public officials witnessed at a fire test recently conducted by the Pittsburgh Testing Laboratory of building material manufactured by the Straub Patented Building Block Co., H. M. Collier, Mgr., Warren, Ohio.

The test was made on a cinder concrete block building located on the company's property. Mayor McBride applied a torch to boards and timbers saturated with oil, which filled the building.

Electric pyrometers were placed in the building by P. J. Freeman of the Pittsburgh Testing Laboratory to record accurately the temperatures. When the fire had burned fiercely for one hour and ten minutes, a temperature of 1600 degrees had been reached. This, according to experts, was much hotter than is reached in a residence, garage or factory fire.

When the fire was at its height, firemen turned a stream of water on the inside of the building. Contractors examined the structure as soon as the fire had been extinguished. Neither the fire nor the heat had injured the blocks in any way.

Insulating properties of the cinder block were shown by a test of one wall of the building, built of 4-inch solid cinder block. While the inside surface was exposed to a heat of nearly 1700 degrees, the outside was but 120 degrees.

The test house was provided with chimneys built of block also made by the Staub patented process. The flames shot up through these openings and made the inside red hot, although they were cool on the outside.

Cinder block manufactured under the Straub process is to be made an important part in Warran manufacturing.

The Straub Co. has taken over the plant on North Tod avenue and Erie R. R. and its capacity will be greatly increased.

New machinery, which was recently shipped from New Kensington, Pa., will be installed within two weeks. With this equipment, 10 blocks can be made a minute, which will mean a daily capacity of 6,000 blocks.

It is the intention of the company to operate the local plant at full capacity, manufacturing a surplus of blocks to take care of the spring building demand.

The Pyramid Tile Machinery Co., 434 Marquette Bldg., Chicago, manufacturers of molds and equipment for manufacturing concrete interlocking building tile, laid without mortar is now arranging and collecting material for an educational exhibit and demonstration of PYRAMID TILE and concrete specialties to be held in Los Angeles soon after January 1.

Their plans call for the renting of the best display store possible where the greatest number of people pass. In one window they will have an automatic machine making PYRAMID TILE to attract attention as of course where the wheels are turning it catches the eye. In the other window they will have a display of TILE with attractive pictures and signs inviting the public inside for further particulars, hear the lectures and see the exhibits. All during the day and into the evening their lecturers will tell of the merits of concrete construction and of course explaining the advantages and demonstrating PYRAMID TILE.

They shall also have on the walls and other convenient places, sign, photos, posters, etc., inviting the public to get more information by reading the circulars or talking with their managers who will be pleased to answer any questions. Expect to have an architect, engineer and contractor in attendance to answer questions and give information on concrete costruction as well as to give estimates. All this with a view of creating a demand for PYRAMID TILE and the selling of equipment for its manufacture. The demonstration will be in charge of their Mr. McCallum, the president of the company, who has had many years experience doing this kind of selling which assures its success. During a thirty day exhibit and demonstration Mr. McCallum estimates we will distribute between 15,000 and 20,000 circulars.

Manufacturers of concrete block and building units have recently organized the Columbus Concrete Products Association with the idea of standardizing their products. The officers include George Lang, secretary and general manager of the Cunard-Lang Concrete Co., as president; Al C. Dale, contractor, as secretary, and Isaac Silver, treasurer. One of the first subjects to engage the attention of the association members will be the matter of working out a building code, covering the use of concrete products and submitting this code to the city for adoption.

The code will be prepared with the assistance of local engineers, architects, and builders and will be drawn up in conformity with American Concrete Institute specifications, similar to the codes now in use in Cleveland, Detroit and Pittsburgh. The specifications provide that all blocks shall be tested at least every six months for compression and absorption in a laboratory of recognized standing at the expense of the manufacturer. It further requires that all blocks shall be branded and provides for the licensing of the manufacturer by the city building commissioner before the block can be manufactured or sold.

The institute further requires that block shall meet a compression of at least 1,000 lbs. per sq. in. on the gross area of the block while the absorption test must now show an increase of more than 10% of the original weight on 48 hours' immersions after the block has been dried at a temperature of 212 degrees F.

Concrete block manufacturers in Columbus, Ohio, have erected a concrete block building at Town and Scioto streets, which they propose to fire next Monday, in connection with the national fire prevention campaign.

Officials interested in lowering Columbus' fire loss will be present at the demonstration. Mayor Thomas has been invited to light the fire. Invitations have been sent to every concrete manufacturer in Ohio.

The walls are of concrete block laid in cement mortar. The outside of the walls are stuccoed with cement and finished with a splatter dash. The rafters of the roof, door frames and window frames are the only wood used in the building. Plastered metal lath are used for a fire barrier to keep the flames from attacking the rafters and the eaves.

YOU CAN MAKE BIGGER PROFITS

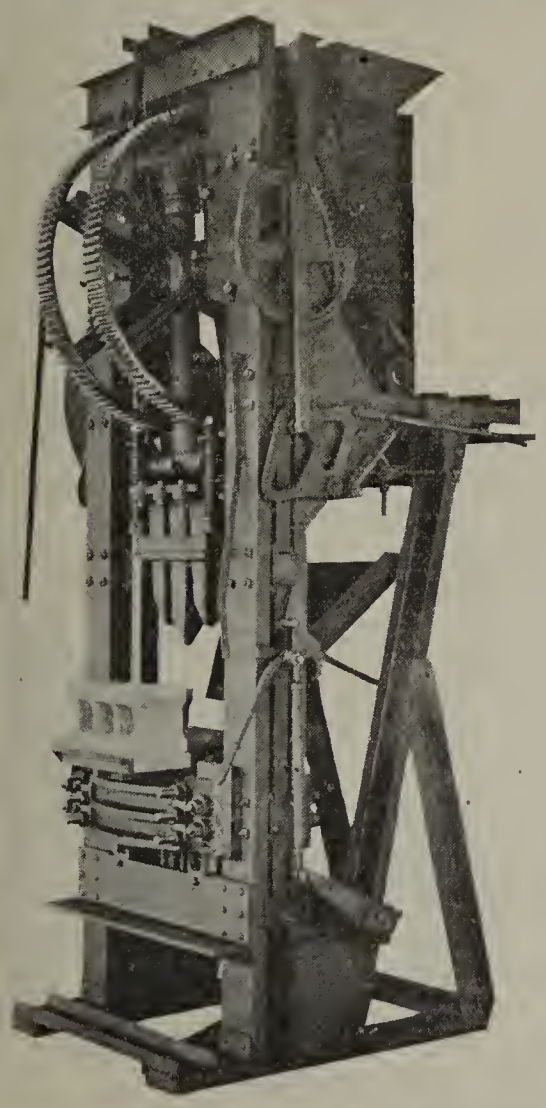
AT LAST! AN AUTOMATIC BLOCK MACHINE

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block by the

Post Economy Punch Block Machine

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.



This machine is the invention of A. L. Post, the inventor of the Kent Continuous Concrete Mixer, which is well known to concrete products manufacturers. It is the invention of a practical block manufacturer, has been thoroughly tested and has convinced men thoroughly versed in concrete block manufacturing that it produces block that are very dense in structure, free from voids, absolutely square and smooth, and which stands the various building code tests, both as to structure and absorption.

We are now placing on the market the following machines, to be known as the

RED LINE PRODUCTS

Automatic Tampers
Block Machines
Block Cars
Lift Trucks
Gravel Screens
Continuous Mixers
Batch Mixers
Elevating Devices
Electric Motors
Gas Engines

KENT MACHINE CO.

KENT, OHIO

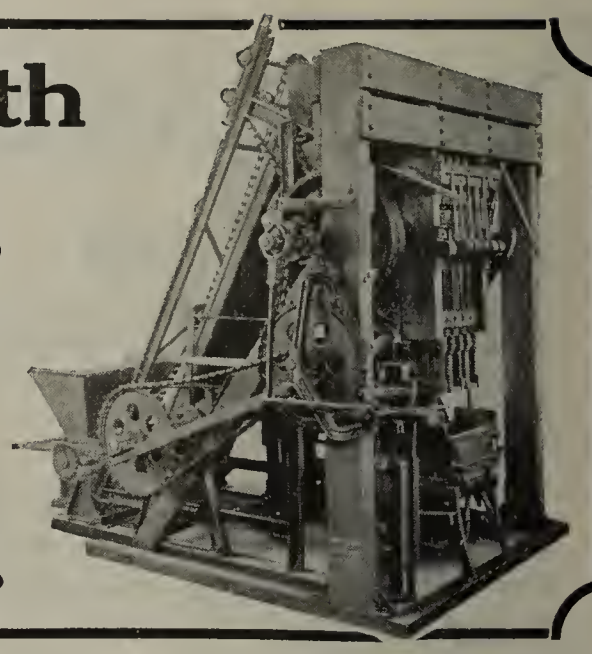
"Full Speed Ahead" with

Ideal *Automatic Concrete Block* **Machines**

Spring building activity starts soon—arrange now to produce attractive, true, shapely blocks. With our modern equipment, you can make blocks in 12 seconds, reducing 23 motions to one.

Hand or power models—they fit right in with your present outfit.

Write for Catalog 35 today.



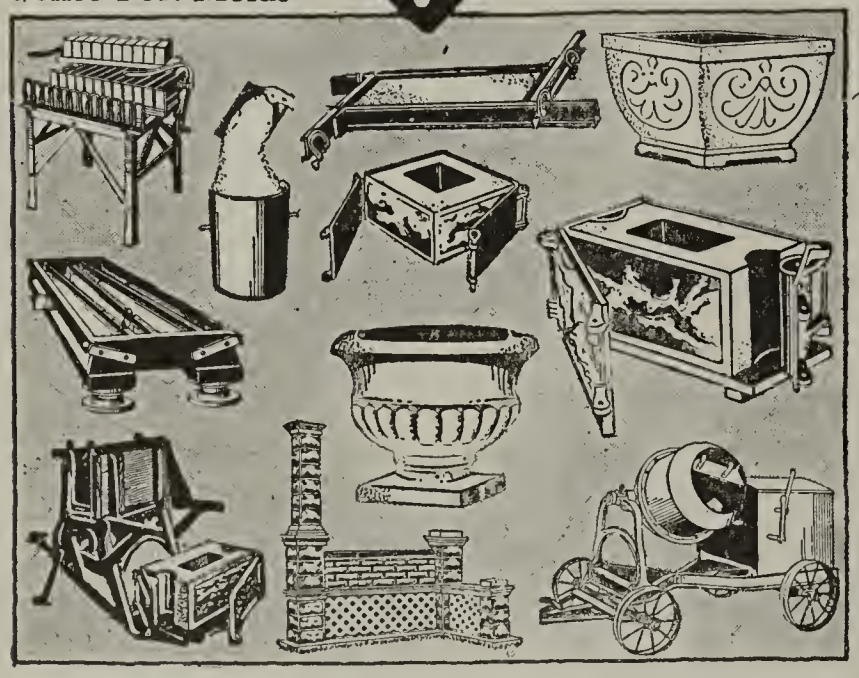
The Ideal Concrete Machinery Co.

1338 Monmouth St.
Cincinnati, Ohio

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds



Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

Contractor Specifies "Medusa" for His Own Home

This charming residence at Portland, Oregon, was built by Mr. H. O. Triplett, a designer and contractor of that city, for himself.

Specify and use Medusa Stainless White, plain or waterproofed, in your cement jobs, and Medusa Waterproofing in every concrete wall, foundation or floor where moisture must be kept out.

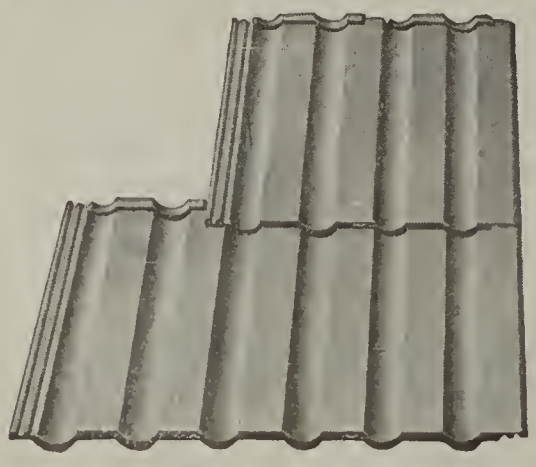
Write today for the Medusa Literature.

THE SANDUSKY CEMENT COMPANY
Department E Cleveland, Ohio

Ask to have your name placed upon the complimentary mailing list of "The Medusa Review."

MEDUSA Stainless White Cement

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

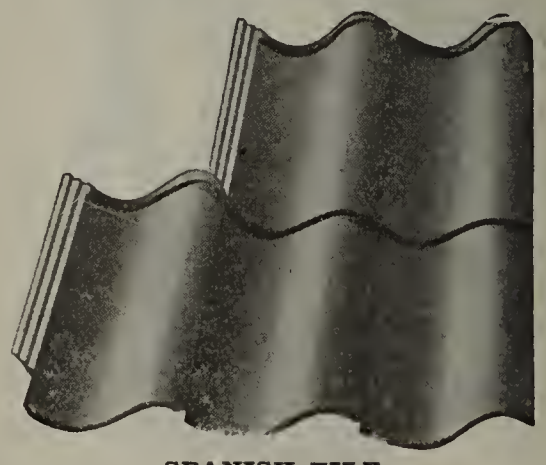
Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name. "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.



SPANISH TILE

Automatic Sealing Vaults

The concrete burial vault business is good RIGHT NOW

Can you imagine what effect a period of building depression has upon the business of manufacturing and selling burial vaults?

It has absolutely no effect.

The demand for burial vaults of all kinds is governed by the law of mortality which no man can change. It is absolutely constant.

The demand for concrete burial vaults is steadily increasing due to the growing appreciation of a permanent vault in the minds of the general public.

Upon such a solid basis of continued demand, is the prosperity of the burial vault business founded.

Any man with a concrete plant or with concrete experience or with concrete equipment or all three will find upon even the most casual investigation that the manufacture and sale of concrete burial vaults, if they are of the right type, present an unusual opportunity for founding a business that is not subject to fluctuating market, a business which changes steadily only in one direction, that is up.

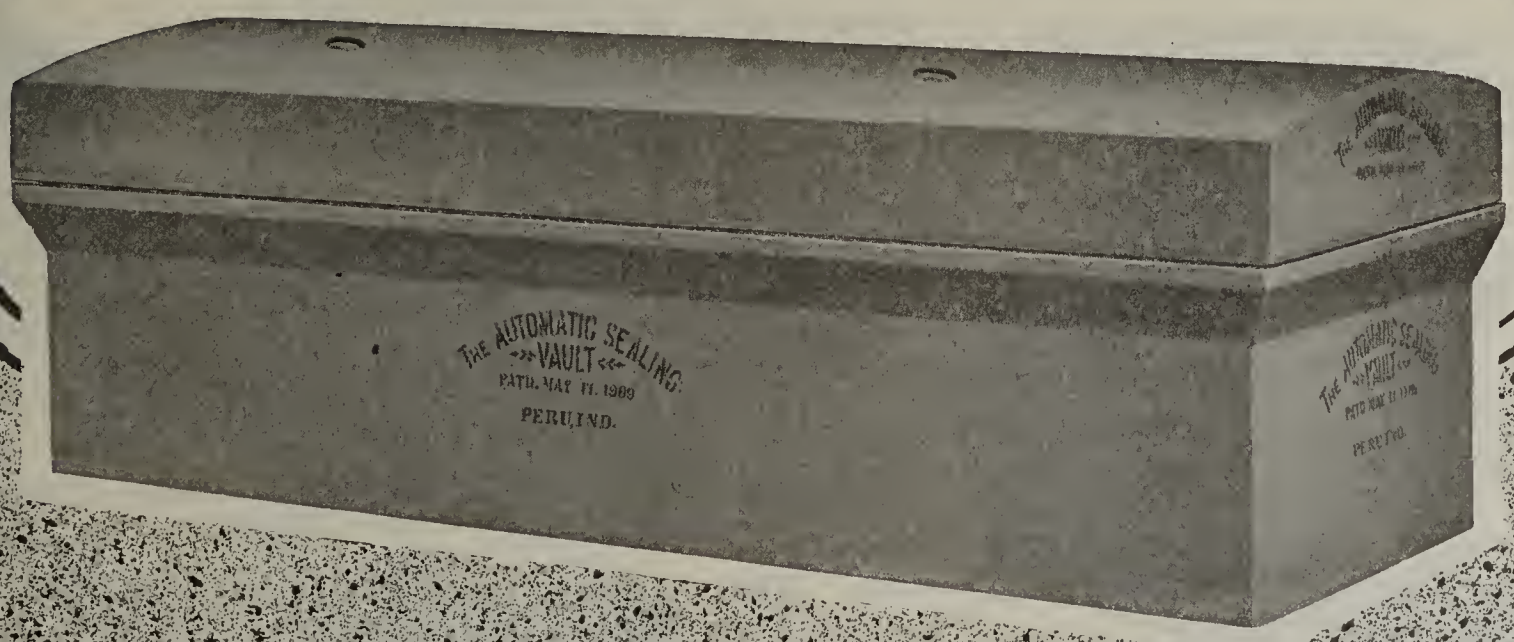
It takes a little money to establish the business, it requires very little floor space, a minimum of equipment and involves no special labor problems. It is in no sense a seasonal business as the demand in one month is just as great as the demand in any other month, depending of course upon the mortality rate.

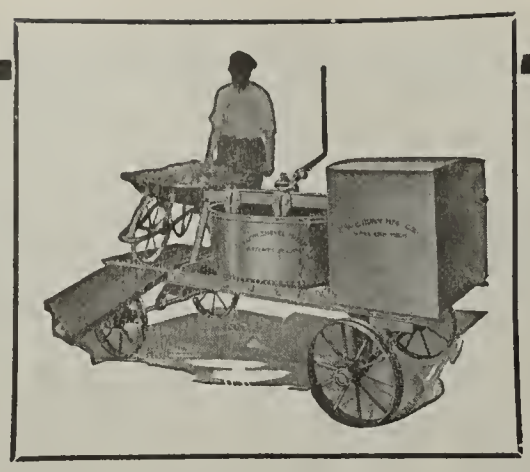
The manufacturing process is simple, the selling plan easy.

Every burial vault factory that was founded right is prospering today. It is prospering at a time when a good many other concrete men find themselves without a business. Isn't now a good time to investigate it?

AUTOMATIC SEALING VAULT CO.

216 East River Street, Peru, Ind.





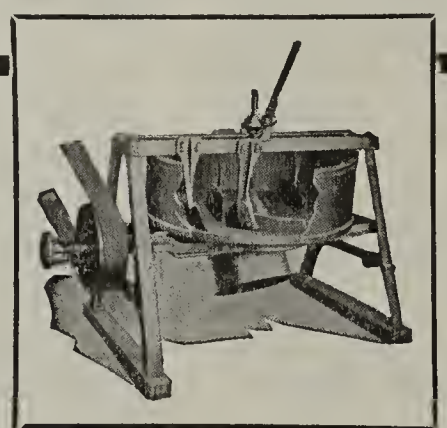
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



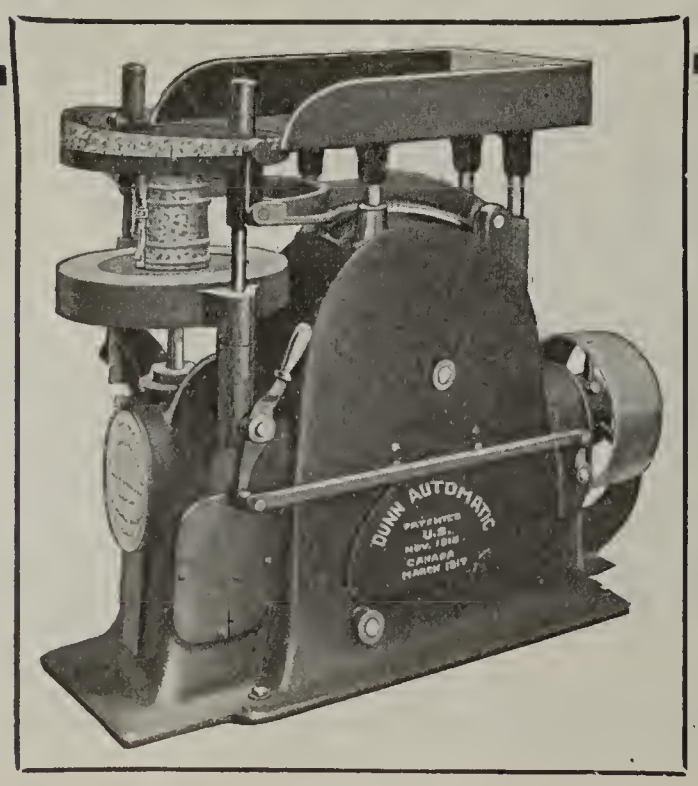
The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.

It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

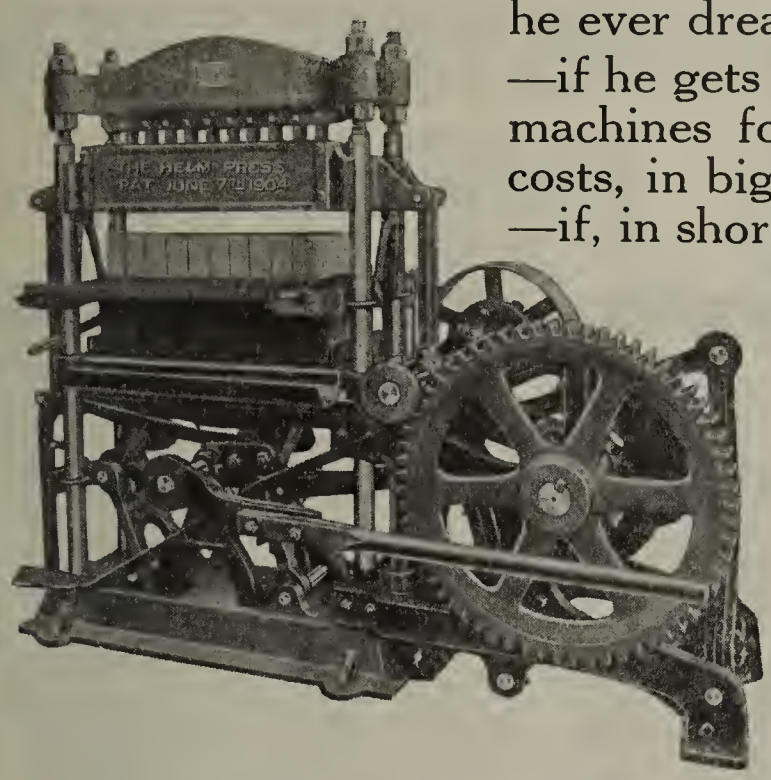
414 W. 24th Street

HOLLAND, MICHIGAN

NOW Is the Time to Prepare

Now is the golden opportunity for the concrete products manufacturer, if he moves quickly enough.

—if he starts NOW to equip his plant to turn out more block and brick than he ever dreamed before of selling.



—if he gets quick-action, repairless, reliable, automatic machines for making his products at low production costs, in big quantities.

—if, in short, he will investigate the Helm press, install it, get it operating, make up a reserve stock and be ready to handle orders when the flow starts—, and it'll start extra early this spring.

You should buy a Helm brick and block press because your production is unlimited—you can turn out 15,000 brick or 1,500 24″ block in a day.

This Booklet tells all about the machine and the business. WRITE FOR IT.

THE HELM BRICK MACHINE CO.

861 MITCHELL STREET CADILLAC, MICH.

"Perfect" Concrete Block Power Machine

C. S. WERT Inventor and Patentee

Built entirely of steel and iron.

Turns out, with four men, 1,000 to 1,200 concrete blocks in ten hours.

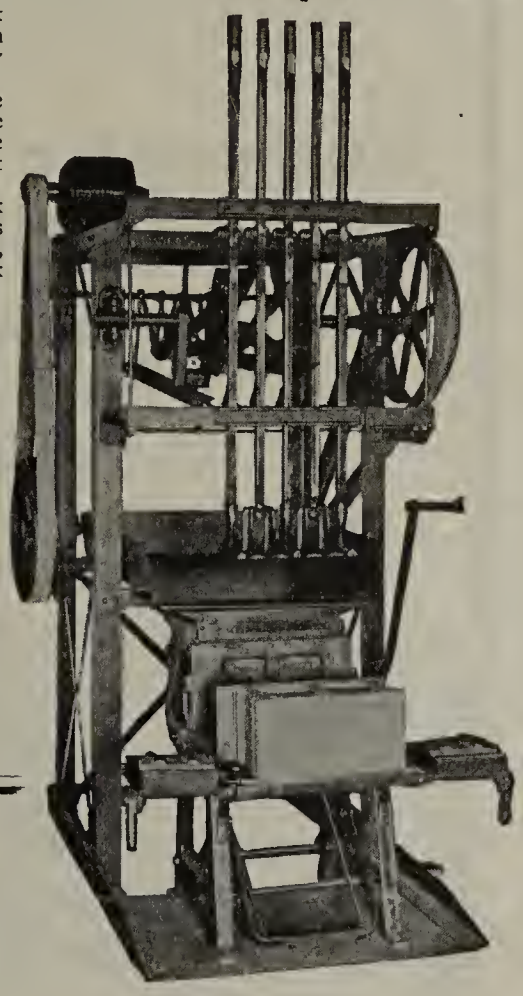
In severe tests, Perfect Concrete Brick have proven stronger than common clay and pressed clay brick.

The power tamper may be operated by a one horse power motor, a 2½ horse power gas engine or direct from a line shaft.

"There is no better brick machine manufactured," says W. T. Sharp, of Montana, owner of a Perfect brick plant.

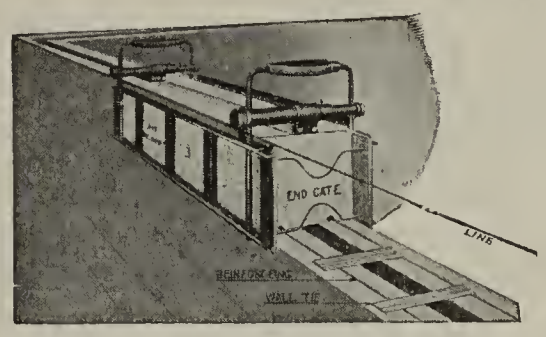
Get facts and figures now. Write while the matter is on your mind.

Also Hand and Power Brick Machines
Hand Brick Machines
Well, Cistern and Silo Molds



Manufactured by
The Wert Manufacturing Co.
547 Railway Exchange Bldg., Chicago

Build the Hollow Wall Way



Like a thermos bottle—warmest in winter—coolest in summer. Fire-proof—everlasting.

Cheapest, best and most perfect way known to the building world.

The reason the most wall can be built for the least money with our forms is—because they are STRONGEST—LIGHTEST—SIMPLEST and MOST PERFECT, and the price of a complete set can be saved on one small job. Send for literature.

The Universal Cement Mold Co.
North Milwaukee Wisconsin

THE POLK SYSTEM

All-Steel Machines for All Kinds of

Circular Concrete Construction

We contract grain storages.

Polk Genung Polk Company

521 Occidental Bldg.
Indianapolis, Ind.

Fort Branch,
INDIANA

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
supplying cement works with

Chemical Apparatus, Chemicals and Reagents

Gilmore's Needles, Cement Moulds, Vicat Apparatus,
Schumann's, LeChatelier's and Jackson's
Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters

High Grade Goods Only

Satisfaction Guaranteed

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16″ blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16″ back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Company's Concrete Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

—Here's a Booster Winter Proposition

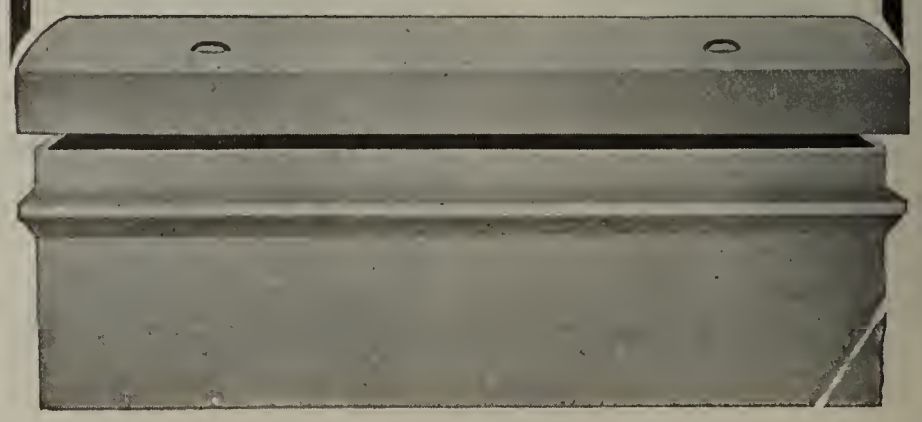
Here's a proposition you should be interested in. You can make money during the winter just as well as during the building season by manufacturing and selling the

Automatic Sealing Vault

Make them in our Bessemer Steel Molds, adjustable to seven sizes—making a perfect self-sealing vault that keeps the contents proof against air, moisture or vermin.

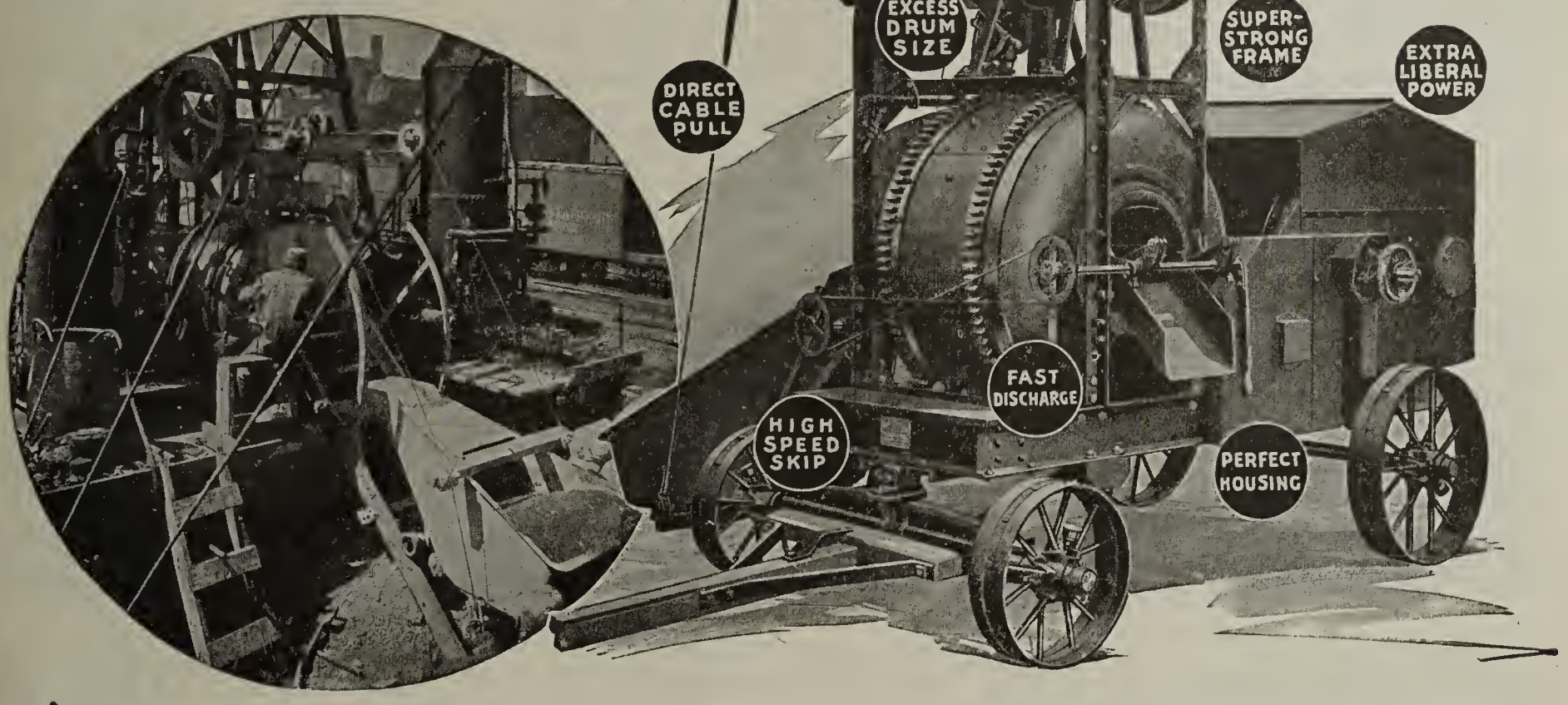
Write today for information regarding this Money-Making proposition.

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.



KOEHRING

HEAVY DUTY MIXER



THE **surest-profit** factor you can bring on a job—mixer dependability in the form of Koehring heavy duty construction.

Koehring-mixed concrete is **Dominant Strength** concrete, so established by official tests whereby Koehring mixed concrete has been proved to be as much as 31% stronger than concrete mixed by other mixers.

Due to the Koehring **re-mixing** action Koehring-mixed concrete is uniform in distribution of aggregate to the last shovelful of every batch.

Write for Koehring catalog No. B-5—a book that shows in detail Koehring heavy duty construction—shows you how to judge mixer value.

Koehring Capacities

in cu. ft. wet batch rating

Pavers 10, 14, 21 and 28 cubic feet mixed concrete, with or without loading derrick.

Construction Mixers, 7, 10, 14, 21, 28 cu. ft.

Hot Mixers for bituminous work, 9, 14 cu. ft. side charging type; 18 cu. ft. paver type.

Gasoline, Steam and Electric Power.

DANDIE LIGHT MIXER

Koehring Dandie Light Mixer—4 and 7 cu. ft. capacity, wet batch rating—a light mixer that brings dependability into the light mixer field—at a price that makes it the remarkable value of the industry. The reasonable investment mixer for miscellaneous work on big contracts, for footings, culverts, silos, etc., or for all general work within capacities. No. 104-S, gasoline, No. 107-S, steam and gasoline—may be equipped with standard or batch hopper, low charging platform, or power charging skip, automatic water-measuring tank or light duty hoist. Write for catalog B-45.

KOEHRING MACHINE CO., Milwaukee, Wis.

Sales and Service Offices and Warehouses in all parts of U. S.

The Modern Way To Dig and Convey Gravel

Evidence is available to warrant the statement that a Sauerman Dragline Cableway Excavator can dig and deliver to the hopper of a washing and screening plant, any definite tonnage of sand and gravel at a lower per ton cost than is possible with other equipment or combination of equipment.

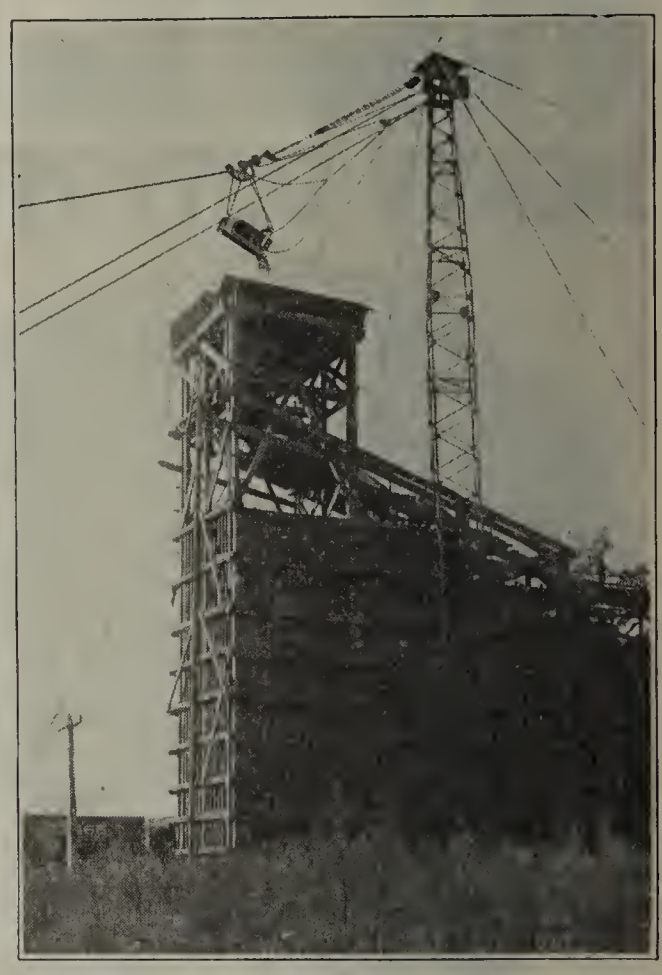
The cost data forming the basis of our claim has been supplied by prominent gravel producers who have operated Sauerman Dragline Cableway excavators for a considerable length of time. Some of these producers employ several of our equipments at different locations with consequent variations in ground conditions and none of the cableways has been favored by especially ideal digging conditions.

If you are figuring on developing a gravel proposition, you too, will find it to your advantage to ask our engineers to submit their recommendations.

Write for Bulletin No. 14

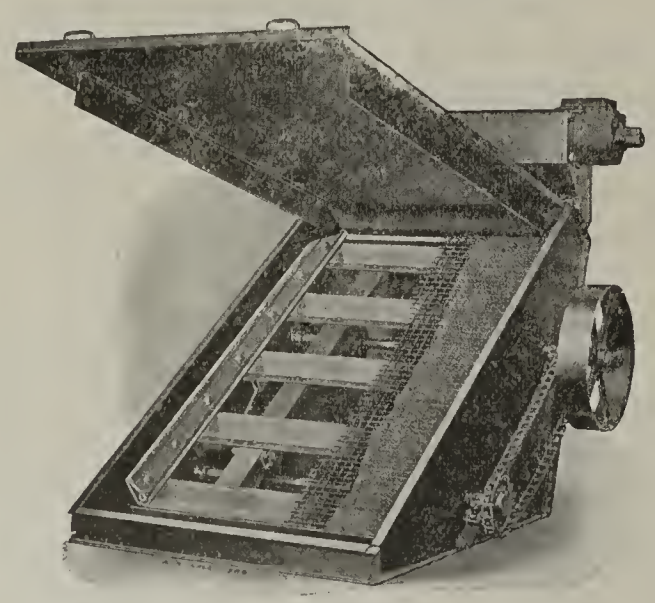
Sauerman Bros.

1139 Monadnock Bldg., Chicago



Sauerman Dragline Cableway Excavators

STURTEVANT "ONE-MAN ONE-MINUTE" "OPEN-DOOR" MACHINERY



"Bucking Broncho" Separator

A plant that tries to screen without a "Bucking Broncho" has yet to know true screen efficiency.

A simple, durable, inclined screen, built upon principles never before attempted, and which has proved a remarkable success. It not only has all the vibratory motion of other screens, but also has many others, not heretofore utilized. It not only has the ordinary up and down motion, but has a further to and fro and lateral motion, as well as a rotating motion, together with many slaps, jars and shakes. This tremendous amount of vibration not only screens the material far better than any former device, but also considerably augments its capacity per square foot of screening surface.

Its screening surface is not stretched, yet it cannot sag even if one stands upon it, because it is held up by the coarse foundation wires, resting on the saddle.

CRUSHERS—GRANULATORS—GRINDERS—PULVERIZERS—
SCREENS—MIXERS—ELEVATORS—CONVEYORS—CHUTES

STURTEVANT MILL CO., BOSTON MASS.

HARRISON SQUARE

NEW YORK, SINGER BLDG. CHICAGO, PEOPLES GAS BLDG. PITTSBURGH, 1ST NAT'L BANK BLDG. ATLANTA, HEALEY BLDG.

Cement and Engineering News

Vol. 34 Chicago, March, 1922 No. 3

Research in Concrete and Concrete Materials

An Example in Cooperation.

Service, is shown very well in the work of the Structural Materials Research Laboratory as carried on through the cooperation of the Lewis Institute and the Portland Cement Association.

Just off the floor of the Strength of Materials Laboratory in the Lewis Institute there is an office in which you will sometimes find Mr. Duff A. Abrams, professor in charge. Mr. Abrams has shown such sufficient reason for accumulating floor space that, while his own office remains inconspicuous, the work-rooms of his laboratories now cover the equivalent of two floors in the engineering building. If he keeps at it the institute may have an argument on their hands to keep him out of their new garage and the new forge shop.

The policy of the laboratory is vested in an advisory committee consisting of representatives of the Lewis Institute and the Cement Association. The staff carrying on the research work in concrete and concrete materials comprises nearly forty engineers, chemists and assistants who give their entire time to the work. Results of the investigations are published in the form of papers before engineering and technical societies, and in circulars and bulletins issued by the laboratory. The equipment, which is too lengthy to list, is most complete, as you will note from the photographs. The research workers have access to all of the engineering departments of the Institute.

Now mark: "While these experimental studies are being carried on through the cooperation of the cement manufacturers, it should be noted that none of this work has been directed toward the solution of strictly manufacturing problems or with a view to economics in the operation of cement mills. The aim has been to render every assistance in the development of improvements in the quality of concrete, and to adapting concrete to meet the demand for structural material in new fields. This broadminded policy on the part of the manufacturers is a reflection of the most advanced ideas of business ethics which finds expression in the theory that the obligation of the manufacturer does not end in the production and sale of a first-class product, but extends as well to rendering every service in his power to assist his client to a proper use of the product to the end that it may serve its purpose in the most economical manner."

Further, Mr. Abrams says: "These researches will undoubtedly exert an important influence in rationalizing concrete and reinforced concrete construction, to the end that better and more permanent work will be secured at a lower cost. Such benefits as may be derived from these will come to the general public."

While experimental studies carried out in this country and in Europe have developed sufficient information to enable the engineer to design reinforced concrete structures with nearly as much sense of security as in other structural materials, the knowledge of the properties of concrete and concrete materials has not kept pace. This is due to a "lack of complete analysis of the principles of concrete mixtures and has led to rule-of-thumb methods of selecting materials and proportioning." The Laboratory points out that the problems which generally confront the engineer in designing and estimating the cost of concrete structures are:

1. What quality of concrete is most economical?
2. Are the aggregates near at hand suitable?
3. Of several aggregates, all of good grade, which is the best for the purpose?
4. What tests shall be made to determine the suitability of aggregates?
5. How shall the materials be proportioned, mixed and placed in order that concrete of the highest quality may be produced at lowest cost?
6. What is the effect of certain changes in the proportions of the materials?
7. What is the effect of exposures or service conditions on the permanency of the concrete?

And they add that "since the aggregate constitutes 75 to 90 per cent of the material in concrete it is important that aggregates which are found near at hand be used if they can be shown to be suitable."

Not so long ago, to be precise, May 2, 1918, the **Cement and Engineering News** published one of the laboratory reports written by Mr. Abrams which they entitled "Revolutionary Results Obtained by Proportioning Water in Concrete Mixes." So far as I know this was the first break from the old ideas of strength in concrete, and the findings in the report were due directly to novelty in attacking the subject, to methods "without precedent" as the editor said. To quote the opening paragraph of the report:

"Concrete, it is commonly stated, is composed of a mixture of cement, sand and pebbles or crushed stone. This conception overlooks one essential element of the mixture—water. An exact statement of the ingredients of concrete would be: Cement, aggregate and water. The last-named material has not yet received proper consideration in tests of concrete or in specifications for concrete work."

We remarked a while ago that you will sometimes find Mr. Abrams in his office. On the other hand you might be told that he is "out of town." "Out of town" might mean that he is in Colorado or South Dakota or Saskatoon, carrying on tests with concrete blocks in soils and waters at the different stations. Not long ago he returned from Cuba with reports and a coat of tan. As a matter of fact the Cement Association and

the research work carried on covers practically all of the territory on this continent.

In the field tests the Laboratory is receiving cooperation from the United States Reclamation Service, the Bureau of Standards, the Bureau of Public Roads, and the Engineering Institute of Canada.

And it does not take a statistician to prove that the willingness of the cement association to go a second mile unasked will assure their future as a vital part in building industry. The good "two milers," like the really good fighters, seldom require the services of a referee.

The Recent Failure of the Roof of the Knickerbocker Theatre

The recent failure of the roof of the Knickerbocker Theatre at Washington, D. C., resulting in the death of a hundred citizens and the explanation offered by the Government Engineer Investigator, presents a unique contrast between legal fact and mechanical fact. In the Washington Post of February 8th, Col. Kelly is quoted as stating that

"Portions of the roof slab remained, show that the reinforcing steel in the slab was not raised to near the top of the slab over the supports. It is, therefore, improper to figure the slab as continuous. Taking the example of a three inch slab with three-eighths inch round rods on six inch centers with the snow load of 12 pounds and with the dead load of 62 pounds, with a span of ten feet, and with the ceiling supported at the center of the slab, the stress in the steel for a simple span would be practically 25,000 pounds as against an allowable stress of 16,000 pounds."

The foregoing statement under-rates rather than over-rates the seriousness of the misplacement, yet (219 Fed.) the Eighth C. C. A., the highest court (where certiorari is not granted) in a large section of the country, places itself on record that putting the steel in the top of a floor is the plain mechanical equivalent of putting it in the bottom.

What a contrast between legal fact and the probable move to hold a constructor for manslaughter because he followed the legal fact that putting the steel in the bottom of a floor is the plain mechanical equivalent of putting it in the top instead of acquainting himself with the truth.

Under the unscientific system in the United States of America, it thus appears that the builder may be held criminally liable because he follows the holding of the highest courts of the land as to mechanical facts and that the public at large may be blackmailed of three quarters of a million from Maine to California on the legal fiction that putting the steel in the top of the concrete floor is the plain mechanical equivalent of putting it in the bottom, nothwithstanding that this reversal may result in great catastrophies destroying and endangering the lives of citizens. Even the judges whose attention has been called again and again to the error of their conclusions persist in maintaining that error, while the Supreme Court of the Unied States of America, whose duty is to harmonize and make consistent the holdings of inferior courts, like Rip Van Winkle (asleep for the past ten years), although its attention has been directed again and again to this contradiction of legal fact and mechanical fact still allows the public to take its chances of death and destruction by following the erroneous holding of an inferior judicial tribunal.

And by such tribunals the United States patent is reduced to a scrap of paper, the inventor penalized for making improvement and the trial for infringement reduced to the status of a Salem trial for witchcraft in the old Colonial days when the guilt or innocence of the accused was determined on the basis of the mechanical ignorance and unscientific belief of those who adjudged the case.

Will the lives of a hundred of our fellow citizens and a catastrophe so great pass without teaching some elementary lessons? Will the result of such judicial error, the fleecing of the public at large of three quarters of a million from Maine to California and the loss of a hundred lives in the City of Washington, be sufficient to arouse interest and call attention to the unscientific nature of technical decisions by which through no fault of the judges except their lack of competent training, the public is annually fleeced of greater sums than is taken from them by the entire fraternity of bank robbers, confidence men and holdup artists?

Finally, are the results of such ignorance not sufficiently made plain by the pointed report of Col. Kelly? Should there not be some betterment, unless the country at large has fallen into that nonprogressive state of mental dry rot characteristic of the heathen Chinese for the last thousaid years or more?

F. A. CAMP, C. E.

Good Roads Movement

That the good roads movement in the United States and Canada is running on high gear with an impetus that is developing the greatest road building era in all history, was demonstrated at the Twelfth American Good Roads Congress and Thirteenth National Good Roads Show held at the Coliseum in Chicago, January 16 to 20 last, under the auspices of the American Road Builders' Association.

With an attendance of approximately 20,000 and exhibits by 177 exhibitors of some $2,000,000 worth of road-building machinery, methods, materials, appliances and transportation equipment that overflowed the Coliseum and annex into two adjoining buildings, this great event proved to be the largest and most auspicious in the history of the Road Builders' organization. The technical papers and discussions surpassed in quality and instructive value those of any previous meeting, and the sales by exhibitors at the show are reported to have broken all records.

Important action on a number of questions was taken. Among other things the resolutions pledged the support of the American Road Builders' Association to the elimination of advertising signs, grade crossings and interurban tracks from the highways; condemned the attitude of negation displayed by railroad companies and state railroad commissions on the subject of grade crossings; endorsed the pending Woodruff Highway Bill which appropriates $100,000,000 as Federal aid for good roads anually for five years beginning July 1, 1922; urged the Interstate Commerce Commission and the various state railroad commissions to put an end to present existing inequalities in freight rates on road materials, and petitioned President Harding to take such action as may be necessary for the United States to become a member of the International Road Congress.

Other resolutions pledged the association to work for efficiency and permanency in the personnel of all highway departments, and the elimination of partisan politics from highway construction. The Congress

also went on record as favoring a pavement width of not less than 20 feet for all trunk highways or roads carrying dense traffic. Hearty endorsement was given to the efforts being made by various committees to find a method of stabilizing subgrades and of ascertaining the relationship of subgrades to traffic and road surfaces.

In opening the Congress, President H. L. Bowlby, predicted that the present generation will see the time when the United States will have the finest and most extensive system of arterial and tributary highways the world has ever known. "It will be a system," he said, "of beautiful paved roads, properly located, adequately drained, splendidly shaded with trees, adorned in many instances with hedges and shrubbery and in other instances, edged with sidewalks; lighted by electricity. kept in repair by working patrols and protected against highwaymen by squads of mounted state police. Grade crossings ultimately will have disappeared and it will be possible for tourists and others who traverse the highways to use them in greater safety. All of this will tend to make rural life more popular and will have a certain measure of effect in arresting the migration of so much of our rural population to the cities."

Quick Setting Cement

By J. L. Goffette

Two years ago I made tests for a cement company. The president, who was assisting at the demonstration, was delighted with the results and asked me to make for him ten sacks of cement to be tested by several cement experts. I agreed to make 100 sacks of cement for him on condition that if the tests were satisfactory he would manufacture this material and pay me for my process. He consented to this and it was agreed that a contract to protect my interests be drawn up in due form. He had his attorney draw up a contract, but if I had signed that document I would have been robbed of my process and I refused to sign.

Would like help from reliable parties to put my process on the market.

Progress demands Quick Setting Cement, but sometimes there is a hindrance in the way of progress.

America is handicapped by the lack of any supply of quick-set or prompt cement. Indeed, the cement manufacturers and cement chemistry experts to whom I referred were evidently ignorant of the very existence of such cement, plainly supposing that I had in mind the mischevious flash-set, to avoid the trouble caused by which portland cement makers add obnoxious materials suc has gypsum or chloride of calcium.

For the benefit of the cement industry, I beg to explain some of the salient characteristics and uses of the material in question.

The cement, in the first place, is not so much a quick setting as a variable setting product. It is possible to work it at extreme speeds (with both initial and secondary set as low as, say, 15 minutes) and it is indeed frequently both necessary and desirable to do so.

Cement can be made to set up in fifteen hours or five minutes at will. The possibilities of this extremely quick set-up can plainly be seen. Its true hydraulic crystallization properties are sometimes of great practical use and have the great advantage of permitting the execution of some difficult work and of creating artistic results. This is impossible with slow setting cement. Take, for instance, the drying-up of a basement under hydrostatic pressure of incoming water: With the rapid setting cement any basement below water level can be made water-tight in a remarkably short time and can be guaranteed absolutely water-tight. Quick setting cement gives that perfect result and does not require any waterproofing compound or foreign material. Good results cannot be obtained with slow setting cement, even in a basement where there is low water pressure. In 90 per cent of cases basements are not properly dried and where there is water pressure (even if concreting has been done) 100 percent are full of water.

An Engineering Contracting concern I know in Los Angeles has gone into bankruptcy. They had built some oil reservoirs which, on being tested, leaked like a sieve. The firm would not have been ruined if they had used rapid setting cement, that would have made their reservoirs oil-proof. There has been a tremendous amount of trouble in this kind of work, and engineers have in some cases had to use bran to effectively seal sub-surface tanks which were leaking. This needs no comment, but apparently in hydraulic engineering we are about five centuries behind the times.

For exterior finish, rapid cement enables the cement contractor to clean up a job in hours with absolutely incontestable superiority where ordinarily he would have taken months. I have seen cementers take two months (where the architects' specification called for three coats) to make so-called first-class stucco work. The stucco was never impermeable and was full of cracks. With rapid setting cement you can make a first class job in one day and the stucco will be absolutely impermeable and will not crack.

In an art studio, where artists have to cast artistic cement pieces, gelatine or plaster moulds are reapidly destroyed. Slow setting cement takes so much time before the mould can be taken off. With rapid-setting cement you can make a cast every 30 minutes.

Not to have rapid setting cement in a country like America is a disgrace to our present state of scientific achievement.

I do not fear contradiction, but if any point requires further explanation, I shall be glad to prove what I have said and I can make sufficient rapid cement in my laboratory to prove its value.

Please excuse this brief outline, but a whole volume would be required to explain all the merits of rapid setting cement—its application, its valuable properties and qualities and the services it would render to the art of construction.

I hope very soon to see many cement makers manufacturing it in order to advance the progress and prosperity of the country and to modernize cement work.

Clear Lake Sand & Gravel Company

The new plant of the Clear Lake Sand & Gravel Company, Clear Lake, Ia., is turning out an exceptionally fine grade of washed and graded sand and gravel. The capacity is between 20 and 30 cars per day. The company owns 150 acres of land containing extensive deposits of high grade material. The plant was built by Mr. H. D. Keerl, who is also vice-president and general manager, from designs furnished by the Link-Belt Company, who furnished the washing and screening equipment.

A Sauerman Dragline Cableway, operating a one and one-half yard bucket over a span of 650 feet, delivers the material to the screens, power being furnished by a 150-horse-power two speed electric hoist.

Continental Portland Cement Company Increases Capacity

Recognizing the increasing demand for cement in St. Louis and its vicinity, the stockholders of the Continental Portland Cement Co. last year increased its capacity from 2,500 barrels to 4,000 barrels per day.

The plant is located near Jefferson Barracks, south of St. Louis and was built in 1908. At this point limestone and shale are found in abundance and of a character suitable for the manufacture of portland cement. Limestone deposit is situated on the left bank of Gravois creek, which rises to a height of about 100 ft., of which 85 ft. has been opened and in which the quarrymen are working. Or considerable overburden is encountered, which is stripped off with steam shovel and hauled away on Continental dump cars. Seams in this rock vary in width, some of which are large enough to permit a man to enter. Where possible the contents of these seams are removed before the face of the quarry is shot.

Many factories had to be taken into account in planning and building this betterment. The entire plant, from quarry face to packing machines, was to be enlarged and the quantity of material actually handled was to be increased.

There is lack of room in the small valley in which the plant of the Continental Portland Cement Co. is located, and this room had to be used to the greatest possible advantage. When it is known that this improvement involved an expenditure of considerably over $1,000,000, the extent of the betterment may be appreciated.

A complete Woodford haulage system was installed which takes the limestone from the face of the quarry to the receiving grizzly feeder. Cars loaded by the shovel are set in motion and transported to the grizzily feeder. The same car is taken back to the shovel, passing through two switches, and set along side the shovel are set in motion and transported to the grizzly in transit.

Entirely new facilities and machinery have been installed for handling stone from the time it leaves the car, until it enters the dryer. This new system embraces some very interesting methods of handling stone. Quarry cars hold 15 tons of stone. These are dumped into the hopper of the grizzly feeder, which is presumed to take out all stone under 6 ins. in size. The remaining stone is fed to the jaw crusher, which will take anything that can be loaded by the steam shovel.

A Traylor jaw crusher, 48 by 60 ins., takes stone as large as the steam shovel can handle. This jaw crusher, together with the fines which go through the grizzly delivers to a 42-in. belt, 27 ft. between centers. This acts as a feeder belt and discharges on a faster moving 36-in. belt, 100 ft. centers, which carries the material to a grizzly screen, the fines going through this screen and passing on to the rolls, and the oversize being fed to a No. 9 gyratory crusher, formerly used as a primary crusher but now used as a secondary crusher.

Clinker storage yard of Continental Portland Cement Co. Traveling crane handles clinker

Passing through this crusher the material is discharged onto a short belt, about 25 ft. long, which feeds into a 24 by 54-inch roll, which reduces it to 1⅛ ins. size and under. Material is discharged onto a 30-in. belt, 93 ft. long, running in opposite direction to the belt which carries the material from the jaw crusher, and elevating it to a grizzly. The grizzly discharges onto another 30-in. belt, 216 ft. between centers, which conveys it into the storage house and discharges it by tripper where the material is most needed.

The new storage house is built of concrete. It is built to house 14,000 tons of crushed stone, which amount can be taken out by the belt conveyors, located in tunnels beneath the storage. Allowance is made for leaving about 8 ft. of stone alongside the tunnels, which will not "flow" to the tunnel openings.

Two methods were considered in building this house. One was to build the tunnels below the floor, which

would necessitate tunneling in rock, but which would give the entire contents of the storage house. This method was abandoned when it was found that the tunnels would be moist, being below water level.

Three tunnels have been constructed, in each of which there are two belts. Four of the belts are 350 ft. long and two of the belts are 125 ft. long.

Rock Drying and Preliminary Grinding

These belts, when in motion, carry the stone and deliver it to the rock dryers where the surplus moisture is driven off. From the rock dryers it is carried into tanks from which it is fed out on poidometers. With the aid of poidometers the chemist can regulate the proportions of raw material for the mix. The combined materials then are ready for the preliminary grinding.

This is done in ball mills, which do the preliminary grinding. From these ball mills the material is carried to 3-compartment tube mills, where the preliminary grinding is finished. The finished material is then elevated into the six concrete tanks, which hold 8,000 bbls. or enough for 48 hours' run.

Kilns are 8 by 110 Ft.

Material is taken from the silo storage tanks to the kiln tanks. There are six kilns, 8 by 110 ft., which burn the material into clinker. The pitch of these kilns was ⅝ in. to the ft., but in the remodeling process to insure better burned clinker, the pitch was lessened to ⅜ in. to the ft. This calcining process is thought to be much better than ⅝-in., and will insure a better output of clinker, which will be better burned and will insure the lowest possible consumption of coal. The kiln man can usually tell whether or not his clinker properly burned by its appearance during the process of calcination and regulates the flow of material accordingly.

Clinker is calcined at about 2800 deg. F. Great care is exercised properly to calcine the clinker, evidenced by changing the pitch of the kilns which is thought to give more intimate control over the material in the kiln.

Clinker Storage

An entirely new system of clinker storage has been put in. Clinker is carried from the kilns by elevator to a point where it is dumped over the wall, shown in the illustration herewith, the three chutes leading downward denoting where the clinker appears. From this point it is picked up by a "Northern" Detroit crane, which piles it for aging at some convenient point. The storage yard is 90 by 200 ft., but no retaining walls have as yet been put in, which would increase the capacity very greatly.

In this manner it will be possible to draw clinker from any part of the yard and, where necessary, to mix the clinker. When the clinker has been cured it is picked up by the crane and deposited on the tunnel into which it is admitted to the tunnel conveyors which take it to an elevator, which trips it onto a weighing machine, where the gypsum is added. From this point the clinker is delivered to track conveyors which deposit it into the tanks of the ball mills. These feed into the ball mills which in turn feed into the finished tube mills.

Leaving the tube mills the cement goes to an elevator which carries it to the cement storage. Packing is done by four Bates valve packing machines.

Coal Preparation

Coal is delivered either by the Frisco or the Missouri Pacific railroad and is dumped into an abandoned part of the quarry. An effective bar from the remainder of the coal is formed by a reinforced concrete wall. This is to prevent the spread of fire should one originate.

Coal is drawn from storage through tunnels by screw conveyors. The coal is elevated to bunkers and passes through preliminary Williams mills, prior to grinding. The company has two coal dryers 5 by 60 ft. From the dryers it is carried by elevators and screw conveyors to the bunkers over the Hardinge mills, after which it runs through a series of screens, the oversize being carried back to the Hardinge mill bunkers, while the fine material is conveyed into the coal bunkers.

This not only insures a supply of coal but separates the various stages of the preparation of the coal so that the dryers, for example, are not in the same building as the Hardinge mills, thus practically doing away with the danger of explosion of the coal.

In the beginning the plan was to provide more capacity. To do this it became necessary to remodel the entire plant and increase certain, almost all, facilities beyond their former capacity.

Solid foundations were constructed for the mills, these being concrete resting on solid rock, which forms the earth's surface at this point.

Tube mills, for example, carried about 10 tons of balls, which was about all the 125-h.p. motors could drive. These mills are now loaded with 25 tons and are driven by 300-h.p. motors.

Four Hardinge mills have been put in. Two of these grind coal, and one is used on the raw side and one on the finishing side.

The new traveling crane is entirely new and this outfit for handling the clinker is built from the rock up.

A new 1200 cu. ft. air compressor, manufactured by Sullivan, has been installed.

F. R. Loveridge is assistant superintendent, and J. C. Josse is superintendent; H. O. Ritter, chemist.

Mr. Josse is an ideal superintendent.

49th Year of Chain Making

The S. G. Taylor Chain Company are now in their forty-ninth successive years of chain manufacturing, having been organized in 1873.

Recently they have made several additions to their factory and also improvements in the manner of welding their Steam Shovel Chain to keep abreast with the demand for high-grade Steam Shovel Chain.

Their office is located at 640, Marquette Building, Chicago, and their factory, at Hammond, Indiana, where they produce their high-grade Taylor-Mesaba Chain which is a product made of a special grade of iron thoroughly rerolled and refined, free from steel or scrap. They also make a complete line of high-grade chain of all descriptions.

Operating Costs Reduced

The Illinois Malleable Iron Co. of Chicago, Ill., placed an order for an A-4 Ruggles-Coles dryer for drying coal. This dryer will be used to increase their capacity, as they already have a Class A dryer operating in their plant.

Also another order for three Class A-4 Ruggles-Coles dryers has been shipped to the Uvalde Asphalt Paving Co. at Jersey City, N. J. These dryers are to be used for drying sand at the rate of 15 tons per hour, and stone at 12 tons per hour. This installation was effected with the aim of reducing their operating costs rather than increasing the output.

Deflection of Reinforced Concrete Beams of Rectangular Cross Section

Frank P. McKibben, Professor of Civil Engineering, Union College, Schenectady, N. Y.*

Some city building codes prescribe a method of conducting loading tests on floors in reinforced concrete factory buildings and warehouses in case doubt exists as to the capacity of the construction to carry the loads specified by the code. Several codes include a provision that the observed deflection of reinforced concrete floor beams under test shall not exceed 1/360 of the span length. This allowance for deflection is really the maximum permissible for beams of any kind carrying plastered ceilings underneath, and is supposed to be the deflection limit which if exceeded will crack the plaster. This deflection allowance of 1/360 of the span has in most cases nothing whatever to do with the strength of the beam and because of its existence in a code it must not be assumed, as is sometimes done, that when the deflection reaches the limit stated the maximum unit fibre stresses in concrete and in steel are equal to the allowable unit stresses specified for design in the code. In a reinforced concrete warehouse, for example, when the observed deflection of a floor beam under the combined dead weight and superimposed live load required by the code equals 1/360 of the span the maximum unit stresses in pounds per square inch would be far greater than 650 and 16000, in concrete and steel respectively, these being allowances usually specified by building codes for use in design. Many of these so called loading tests, being improperly conducted, are of practically no value for supplying correct information concerning the strength of floors.

General Formula for Vertical Deflection of Beams of Rectangular Cross Section

The following analysis of the vertical deflection due to bending for reinforced concrete beams having rectangular cross sections, will give results in close agreement with observed deflections. The usual limitations and assumptions are made, namely, that plane sections remain plane during and after bending; no tension exists in concrete below the neutral axis; compressive stresses in the concrete are directly proportioned to distances from the neutral axis; moment of inertia of the cross section is uniform throughout the beam's length; the beam's radium of curvature is large.

The letters in the formulas have the following significance:

- $r=$ radius of curvature of the beam at distance x from origin of coordinates.
- $e=$ unit shortening, or longitudinal deformation per unit of length, at compressive surface of concrete at a distance Rd from neutral axis.
- $v=$ vertical deflection of beam.
- $f_c=$ unit compressive stress at outermost surface of concrete.
- $f_s=$ unit tensile stress in steel.
- $n=$ ratio of modulus of elasticity of steel, E_s, to modulus of elasticity of concrete, E_c.
- $b=$ breadth of beam.
- $d=$ depth of beam from compressive surface to center of tensile reinforcement.
- $kd=$ depth to neutral axis from compressive surface; k being a fraction less than unity.
- $jd=$ effective depth of beam, that is, the distance from center of compressive stresses to center of reinforcing steel; j being a fraction less than unity.
- $M=$ bending moment at the section under consideration, x distance from origin of coordinates.
- $p=$ ratio between area of reinforcing steel in tension to area of rectangular section above center of steel.
- $A=$ cross sectional area of reinforcing steel in tension.
- $C=$ a constant in formulas for deflection.

Figure 1 represents a side view and cross section of a rectangular reinforced concrete beam subjected to bending. The shortening of the concrete per unit of length, e, at a distance kd from neutral axis is found by dividing the unit compressive stress by the modulus of elasticity, or $e=fc/Ec$. In Figure 1, where A D and G N are parallel before bending but take the positions A D and F J after bending, from similar triangles O B H and H G F it appears that

$$\frac{I}{r} = \frac{e}{kd} \qquad (1)$$

Moreover as the calculus gives

$$\frac{I}{r} = \frac{d^2v}{dx^2}$$

there results,

$$\frac{d^2v}{dx^2} = \frac{fc}{Eckd} \qquad (2)$$

Referring to Figure 2 it is seen that the relation between the external bending moment, M, and the internal stresses is given by the equation

$$M = \left(\frac{fcbkd}{2}\right) jd = \frac{fcjkbd^2}{2}$$

The value of $fc = \frac{2M}{jk\,bd^2}$ from this equation being placed in equation (2) the following equation of the elastic line results

$$\frac{d^2v}{dx^2} = \frac{2M}{Ecjk^2bd^3} \qquad (3)$$

The double integration of equation (3) gives the vertical deflection as

$$v = \frac{2}{Ecjk^2bd^3} \iint M\,dxdx \qquad (4)$$

For brevity's sake call the factor $\frac{2}{Ecjk^2} = C$

and the general equation for vertical deflection becomes

$$v = \frac{C}{bd^3} \iint M\,dxdx \qquad (5)$$

Application to a Beam Supported at Each End and Loaded at the Center

Figure 3

The first integration of the general equation (5) gives the slope of the beam as

$$\frac{dv}{dx} = \frac{C}{bd^3}\int M\,dx = \frac{C}{bd^3}\int \frac{Px}{2}dx = \frac{C}{bd^3}\left[\frac{Px^2}{4} + C_1\right]$$

The constant of integration C_1 may be found equal to $-\frac{Pl^2}{16}$ by merely placing $x = \frac{l}{2}$ and $\frac{dv}{dx} = 0$, because at the center of the span, the beam being horizontal, the slope $\frac{dv}{dx}$ is zero. The slope of the beam at any point between the left reaction and the central load, x distance from the left support, is

$$\frac{dv}{dx} = \frac{C}{bd^3}\left[\frac{Px^2}{4} - \frac{Pl^2}{16}\right] \qquad (6)$$

*Acknowledgment is made for assistance rendered by Messrs. H. A. Schauffler and W. L. Warner, instructors in civil engineers and mathematics respectively at Union College.

A second integration gives the vertical deflection as

$$v = \frac{C}{bd^3}\int\left\{\frac{Px^2}{4} - \frac{Pl^2}{16}\right\}dx = \frac{C}{bd^3}\left\{\frac{Px^3}{12} - \frac{Pl^2x}{16} + C_2\right\}$$

When $x = 0$ the deflection $v = 0$ and $C_2 = 0$, consequently the deflection at any point between the left support and the central load, x distance from the left support is

$$v = \frac{C}{bd^3}\left\{\frac{Px^2}{12} - \frac{Pl^2x}{16}\right\} \qquad (7)$$

The maximum deflection occurs at the center where $x = \frac{l}{2}$ and equals

$$v = -\frac{C}{bd^3}\,\frac{Pl^3}{48} \qquad (8)$$

The minus sign of equation (8) merely denotes a downward deflection.

$$\text{The Factor } C = \frac{2}{Ecjk^2}.$$

In general equation (5) for deflections, and in the special case of a beam supported at each end and loaded at the center denoted by equation (8) the factor $\frac{C}{bd^3}$ corresponds to $\frac{1}{EI}$ in the ordinary formulas for deflections of homogeneous beams having a modulus of elasticity E and a moment of inertia of I. Obviously then, to find the deflection of any reinforced concrete beam of rectangular cross section under limitations previously specified it is merely necessary to substitute the factor $\frac{C}{bd^3}$ for $\frac{1}{EI}$ in formulas published in the standard works on mechanics of materials. The factor $C = \frac{2}{Ecjk^2}$ may be taken from Figure 4, or it may be computed with the aid of the following fundamental relations for rectangular concrete beams:

$$p = \frac{A}{bd} \qquad k = \sqrt{2\,pn + (pn)^2} - pn$$

$$j = 1 - \frac{k}{3}$$

Verification of Deflection Equations by Use of Castigliano's Theorem

Interesting verifications of general equations (4) and of special equation (8) can be shown by the following method which consists in differentiating, with respect to the load as a variable, expressions for internal work due to flexure, the first derivative thus obtained giving the deflection at the load.

Internal work, due to flexure consists of two parts; —first, that due to compressive stresses in concrete; second, that due to tensile stresses in steel. In this connection it must be remembered that work as here used means the product of a stress by the longitudinal deformation of the concrete or steel caused by that stress.

Since compressive stresses increase proportionally with the distance above the neutral axis the unit stress in the concrete at y distance up from that axis, Figure 2, is $\frac{fc\,y}{kd}$. And as the deformation per horizontal unit of length caused by this stress is $\frac{fc\,y}{Ec\,kd}$ the work done in compression on a strip b wide, of depth dy and of length units, is $b\,dy\,\frac{fc^2y^2}{Ec(kd)^2}$.

The total work on a section of unity length due to compression is

$$\int_0^{kd} \frac{fc^2\,y^2\,b\,dy}{Ec\,(kd)^2} = \frac{fc^2\,kd\,b}{3\,Ec}.$$

Due to tensile stresses in the steel the total work on a section of unity length $= \frac{fs^2\,p\,b\,d}{Es}$

The total work on the entire cross section of the beam for unity length is

$$\frac{fc^2\,kd\,b}{3\,Ec} + \frac{fs^2\,p\,bd}{Es} \qquad (9)$$

As the unit fibre stresses in concrete and steel can be expressed in terms of the external bending moment M by the relations

$$fc = \frac{2\,M}{jk\,b\,d^2} \text{ and } fs = \frac{M}{p\,j\,b\,d^2}$$

equation (9) becomes

$$\text{Work on section} = \frac{4\,M^2}{3Ec\,j^2k\,bd^3} + \frac{M^2}{Es\,p\,j^2\,bd^3} \qquad (10)$$

As $p = \frac{k^2}{2\,n\,(1-k)}$ and $E\,s = n\,Ec$ equation (10) reduces to

$$\text{Work on section} = \frac{2\,M^2}{Ec\,jk^2\,bd^3} \qquad (11)$$

Assuming the load to be gradually, not suddenly applied, the work on the section of unity length would be one half of the value in equation (11) and there results finally,

$$\text{Work on entire beam} = \frac{1}{Ec\,jk^2\,bd^3}\int_0^l M^2\,dx$$

The application of this "work" method to a rectangular reinforced concrete beam supported at the ends and centrally loaded (Figure 3) is as follows:

Work due to bending caused by gradually applied load is

$$\frac{1}{Ec\,jk^2\,bd^3}\int_0^l M^2\,dx = \frac{2}{Ec\,jk^2\,bd^3}\int_0^{\frac{l}{2}} \frac{P^2X^2}{4}\,dx$$

$$\text{Performing the integration, Work} = \frac{P^2l^3}{96}\cdot\frac{2}{Ecj\,k^2}\cdot\frac{1}{bd^3}$$

Applying Castigliano's theorem, which briefly is to the effect that the first derivative of the work with respect to the load gives the deflection at the point where the load is applied;

$$\text{Central deflection} = \frac{Pl^3}{48}\cdot\frac{2}{Ecjk^2}\cdot\frac{1}{bd^3} \qquad (12)$$

Equation (12) verifies equation (8).

Moreover, in what follows it is shown in another manner that the factor $\frac{2}{Ec\,jk^2\,bd^3}$ of equations (8) and (11) for rectangular reinforced concrete beams merely replaces the factor $\frac{1}{E\,I}$ in the usual deflection formulas for homogeneous beams. The moment of inertia of the concrete compressive area about the neutral axis is $\frac{b\,(kd)^3}{3}$, and of the tensile steel area transformed into a concrete equivalent is $n\,p\,b\,d\,(1-k)^2\,d^2$, giving the following:

$$\frac{1}{E\,I} = \frac{1}{Ec\left[\frac{b\,(kd)^3}{3} + n\,p\,b\,d^3\,(1-k)^2\right]} \qquad (13)$$

But as $p = \frac{k^2}{2n\ (1-k)}$ equation (13) reduces to

$$\frac{1}{E\ I} = \frac{2}{Ec\ jk^2\ bd^3}$$

Application

Problem. Given a rectangular reinforced concrete beam weighing 350 pounds per linear foot, supported at its ends on a span of 20 feet, and carrying a concentrated load of 10000 pounds at the center. The section at the center, having been designed for unit stresses of 650 and 16000 pounds per square inch in concrete and steel respectively with n = 15, is 12 inches wide, 25.1 inches in depth to the center of steel, 28 inches total depth, with tensile reinforcement consisting of three ⅞ inch square bars. Compute the vertical deflection at the center due to the 10000 pound load.

Solution. Equation (8) gives the downward deflection as $\frac{C}{bd^3} \cdot \frac{Pl^3}{48}$. The steel ratio, p,

$$= \frac{A}{bd} = \frac{3(.766)}{12(25.1)} = .00765$$

From Figure 4 when p = .00765 and n = 8, C = .0000068.

Substituting in equation (8),

Central deflection =

$$\frac{.0000068}{12\ (25.1)^3} \cdot \frac{10000(240)^3}{48} = 0.103 \text{ inch.}$$

It is obvious that in ordinary cases there is no inconsistency in the use of two values of n, 15 for design and 8 for computing deflections, and tests indicate these two values are reasonable for 1 — 2 — 4 concrete of usable age.

The Colorado Springs and the Interurban Railway Co. Paving Job

Probably the largest single paving contract ever let by any one city at one time was awarded the Colorado Springs and Interurban Railway Company by the city of Colorado Springs on June 24, 1921. This job involved the laying of about 253,000 square yards of asphalt wearing surface on a 5-inch concrete base. The total value, together with incidental work, ran something over $1,100,000. A unique feature of the contract was that any and all profits resulting should revert to the city for the benefit of the taxpayers. In the effort to reduce the expense as much as possible, the most approved layouts of material handling and concrete mixing, were adopted by Superintendent R. H. Kimball of the paving department of the railway company.

At the time the contract was awarded the paving department was formed, the company being at that time without anything in the way of machinery or personnel. By November 1st the job was 40 per cent completed; by January 1st 50 per cent completed, at which time all operations were suspended on account

Central mixing plant with railroad bunkers.

of winter. It is expected that the job will be fully completed by July, 1922.

For this job the central mixing plant method was chosen and the mixed concrete hauled by auto trucks with steel dump bodies of 2 cubic yards capacity. The maximum haul was 3.4 miles and the minimum 1.0 mile. The average being about 2.00 miles. The largest number of trucks in use at any one time on the longest haul was 14.

The mixing plant consisted of a Smith Tilting Type Mixer of 27 cubic feet capacity. Both fine and coarse aggregate was maintained in bins under a railroad trestle, from which it was elevated by belt conveyors to the bunker over the batch boxes. The rock bins were about 350 cubic yards capacity and the sand bins about 300 cubic yards. Water supply came by 2-inch pipe from the main and was measured by a Smith automatic tank. The average mixing time per batch was about a minute and a half. The day record up to October 18th was 419 cubic yards, or 3,016 square yards of 5-inch base. During the period from September 30th to October 13th an average of 2,311 square yards of 5-inch base was maintained per 8-hour day. The 27 cubic foot Smith mixer had no difficulty keeping all gangs and trucks going under full load.

Laying base—3-mile haul.

For this amount of mixed concrete there was required at the central plant one man for each of two conveyor belts, one man charging the batch hopper, one man pouring the cement in the batch hopper. One oiler, one foreman and four extras handling cement from the freight car or warehouse. When using cement from the warehouse the bags were conveyed up to the batch hopper by a belt conveyor. In so far as was possible, concrete was unloaded directly in

the batch hopper from the car, but in order to get the car out of the way and sometimes because the plant was not in operation, it was necessary to unload some of the sacks down a chute in the warehouse.

For the information contained in this article and for the photographs we are indebted to Mr. R. H. Kimball, who had charge of the entire construction, including the layout of the mixing plant.

Concrete Piers for Supporting Lumber Piles

Combination of Concrete Piers and Old Rails to Prevent Dry Rot and Save Cost of Timber Packing,
By Howard Brower, Treasurer, Nassau Lumber Company, Hempstead, L. I.

Lumber piled for a long time is very sure to deteriorate through fungus growth, often in the form of dry rot. The loss from this in a lumber yard in the course of a year is apt to be very large. Fungus growth is a disease and like all diseases, starts in some place peculiarly suited for it. Such a place in a lumber yard is usually in the wooden packing blocks on which the lumber piles rest. This packings stays in place year after year, absorbing moisture, and becomes a perfect breeding ground for the fungus growth. Cases have been known where this growth in the course of

View of front line of rails and concrete piers for supporting lumber piles. Note corner pier has been formed by the use of an old barrel as a mould.

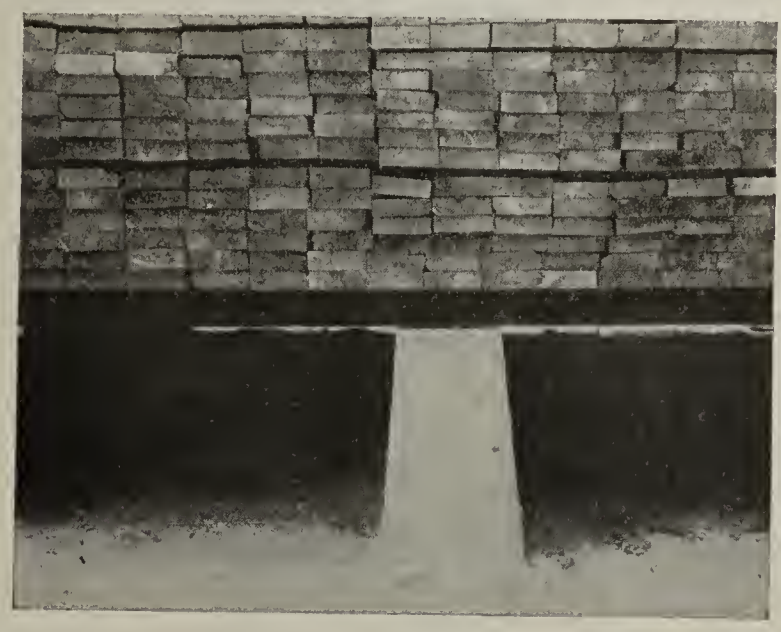
a year would attack the lumber piled on it from a height of from 4 to 6 feet above the bottom of the pile.

By eliminating as far as possible this breeding place of fungus growth the amount of lumber spoiled in this way can be very much cut down. A method of doing this has been evolved by our company by substituting for the wooden packing, steel rails resting on concrete piers.

It would ordinarily be an expensive job to move all the lumber piles and build the racks but if the work is done from time to time it can be handled by the yard force, and in those sections where the piles have been remover for delivery or are so small that they can be cheaply handled.

The design of this packing is very simple and consists of three lines of steel rails spaced 6 feet apart, resting on concrete supports placed 7-ft. 6-inches apart or five piers to each 30 length of rail. These rails are purchased as scrap from the railroad company at a very low cost and weigh 56 lbs. per yard and are about 4-inches high. The piers in the front row are 14x16-inches at the base and those under the middle and rear rows of the rails are 12x12. The heights of the piers are so arranged that there is a slope toward the rear of each pile of one inch to the foot. The mixture consisted of 1 part Atlas cement, 2 parts sand and 4 parts of gravel. This work was handled entirely by our yard forces and in this way no outside labor was involved and the yardmen were kept busy during slow times.

Pits were first dug to the required depth of about 3 feet to bring the base below frost line and the pits filled with concrete to the ground level. In many



One of the piers supporting rails under lumber pile. Note the ample air space under lumber stack permitting free circulation of air.

cases, instead of making the piers square they are circular in shape, because old butter tubs were used as the forms. These could be easily picked up at local grocery stores at a very small price and they make good forms for the concrete work above ground. The cost is far less than it would have been if ordinary lumber had been used for this purpose, and the tubs may be left in place as they are used only once. Details of the location of piers and rails can be readily seen in the accompanying illustrations.

Our company, in line with the improvement secured by installing permanent and fungus-proof packing, is also paving the yard throughout with concrete. This is being done a section at a time until within a year or so the entire yard will have been so paved.

Extra Strong Side-Dump Cars

Side-dump, contractor-type cars seem to be most commonly used for sand and gravel pit operation. But many such cars, built especially for contractors' use, are designed for the life of a construction job rather than for the longest possible service. Naturally, in sand and gravel pit operation the longest possible life consistent with moderately light construction and reasonable cost is the thing sought for.

The Bennett Gravel Co., Spring Lake, N. J., has solved this problem by cars of special construction. These cars have special steel trucks, made of riveted steel girders. Their dumping mechanism is the same as in the standard car of this type, but the sides are especially reinforced by a pair of steel straps and three wedge braces, which give the desired reinforcement against bulging and splintered sides, so often met with in stock cars of this design.

The capacity of these cars is about 10 tons each, and they are handled to and from the pit by 9x14-in. steam saddle-tank locomotives on a haul of about 1,000 ft.

Discuss Concrete Products and Specifications at Convention

American Concrete Institute Meeting at Cleveland Mainly Concerned With Committee Reports —Few Papers Presented

Discussion of current practice, as represented in committee reports, rather than final action on standards or presentation of papers, was the outstanding feature of the annual convention of the American Concrete Institute. One committee presented a specification but a strong opposition minority report accompanied it and the convention referred the specification back for further study. Half-a-dozen papers were presented also, but most of the time was devoted to a discussion of concrete products and houses and to criticisms of the tentative specifications of the Joint Committee on Concrete and Reinforced Concrete. One morning session was given over to a practical demonstration, by Stanton Walker, of the methods used by the Structural Materials Laboratory of the Lewis Institute in designing concrete mixtures. This demonstration was most favorably received, particularly as most of the audience had never seen in practice the proportioning methods advocated by Prof. D. A. Abrams in his many papers on the subject.

In a partial reorganization of the Institute, started last year, it was decided that more attention should be paid to the concrete-products industry, which is experiencing a new lease of life after some years of quiet. Accordingly, three of the sessions were devoted to this subject, including one on concrete houses. In the latter session Miss Kate Gleason, well known as one of the few women engineers, gave a most interesting talk on the group of concrete houses which she has for some years been building at Rochester, N. Y. These houses, of the six-room and garage type, are built to sell for $4,000, and are distinguished by a grace of line uncommon in the quantity-production house They are of beam-and-girder construction, slightly reinforced and of a sand concrete, using metal forms of Miss Gleason's designing. Several other papers described other types of small houses, particularly a cement-gun type built near Boston and described by H. Whittemore Brown and concrete-block houses built in Youngstown, Ohio, described by B. E. Brooke.

Committee Reports

Committee S-5 on Reinforced-Concrete Houses submitted a proposed recommended practice for concrete-house construction, which was accepted as a progress report. J. A. Ferguson, of the committee, presented a lengthy revision of the recommendations as an individual contribution to the subject.

A radical division in Committee P-1 on Standard Concrete Building Units was revealed in the discussion of the report of that committee. New standards for block, brick and structural tile were presented by the committee, but a substantial minority were in opposition. The controversy was mainly about the requirements for concrete tile, which the minority contended would put that material out of the market. The committee was so nearly equally divided that the convention voted to refer the whole report back.

Other committee reports, with an abstract of their contents, are given below. None of the reports required any other action than acceptance by the convention.

S-6 on Concrete Roads.—Progress report. Committee will wait until the many current road tests are nearer completion.

S-2 on Highway Bridges.—Review of some current problems in bridge design, mainly waterproofing and expansion and construction joints.

E-3 on Research.—Citation of research work now going on in United States and Canada. Programs of tests proposed on concrete mixers and theory of proportioning.

P-5 on Fire Resistance of Concrete Building Units. —Program of proposed fire tests on concrete block and tile walls. Convention voted to approve committee's recommendation that $6,000 be raised to carry on such tests.

C-1 on Contractors' Plant.—Addition to last year's analysis of comparative economies of different types of building construction plants.

C-4 on Metal Forms.—Analysis of some of the economic consideration in the use of metal forms.

The flexural strength of plain concrete was discussed in an elaborate paper by Prof. D. A. Abrams, who submitted results of a series of tests on that subject. He finds that flexural strength does not follow compressive strength uniformly. The modulus of rupture does not rise as rapidly as does compressive strength with the increase of cement content nor is it so seriously impaired by the increase of water, though the size and grading of aggregate, the curing conditions and the depth of the beam have about the same effect on both properties. The average modulus of rupture was found to be about 20 per cent of the compressive strength.

Prof. W. K. Hatt reported preliminary results on two series of tests now being conducted at Purdue University, one on the application of the ball test to concrete surfaces and the other on the fatigue of concrete. Each test has gone far enough to promise interesting results though nothing conclusive has yet been learned. They were reported, Professor Hatt said, because of the feeling that it is a good thing to make public the trend of new investigations even though they had not been brought to a conclusion.

A paper entitled "An Accurate Mechanical Solution of Statically Intermediate Structures by Use of Paper Models and Special Gages" was given in remarkably clear abstract by Prof. George E. Beggs, of Princeton University. Prof. Beggs has developed a method of reproducing in paper and celluloid models indeterminate frames and by actual measurement of the deflection of critical members under applied loads has been able, with very simple calculations, to check the results of the complicated theoretical analyses of such frames by the slope-deflection method.

Joint Committee Discussion

One day was devoted to a discussion of the Joint Committee report. Nothing very different from the criticisms developed at the American Society of Civil Engineers discussion in December was brought forward. The main opposition to specification centered around Section 28, on Proportioning, and was mainly directed toward the second alternative of that section which requires that the contractor be responsible for

the strength of the concrete. As a part of the criticism an attack was directed on the cylinder test as a measure of structural strength. Members of the Joint Committee repeatedly asked the critics for a substitute proportioning clause but none was given. Those opposed to the strength specification seemed willing to allow proportioning to continue on its present volumetric basis. A good many criticisms of detail provisions were advanced, but they apparently were largely a matter of interpretation, indicating the necessity of revision to insure clearness in the specification.

Cost of Buildings Analyzed

A. R. Lord, a member of the Joint Committee, presented an analysis of the cost of concrete buildings as designed under the building codes of different cities and under the Joint Committee tentative standard. This showed that for the concrete work in flat-slab buildings the tentative specification would cost 8 per cent more than the average of six cities and for beam-and-girder buildings 10 per cent less, assuming a 2,000-lb. concrete in all cases. This would mean for the whole building 1.6 per cent more and 2 per cent less, respectively. The opposition, however, contended that the requirements for strength, in other words the proportioning specification, under the Joint Committee's ruling, would materially increase any purely structural analysis. A committee of New York contractors presented a comparative analysis of a building under the New York code and the Joint Committee specification which showed increases higher than the averages of the six cities but apparently not much higher than those given by Mr. Lord for New York. The committee, however, contended that the specification is decidedly punitive in its effect on concrete.

The Wason Medal for the most meritorious paper presented to the previous convention was presented to Prof. H. M. Westergaard, of the University of Illinois, for his part of the paper on "Moments and Stresses in Slab" entitled "Analysis of Homogeneous Elastic Plates."

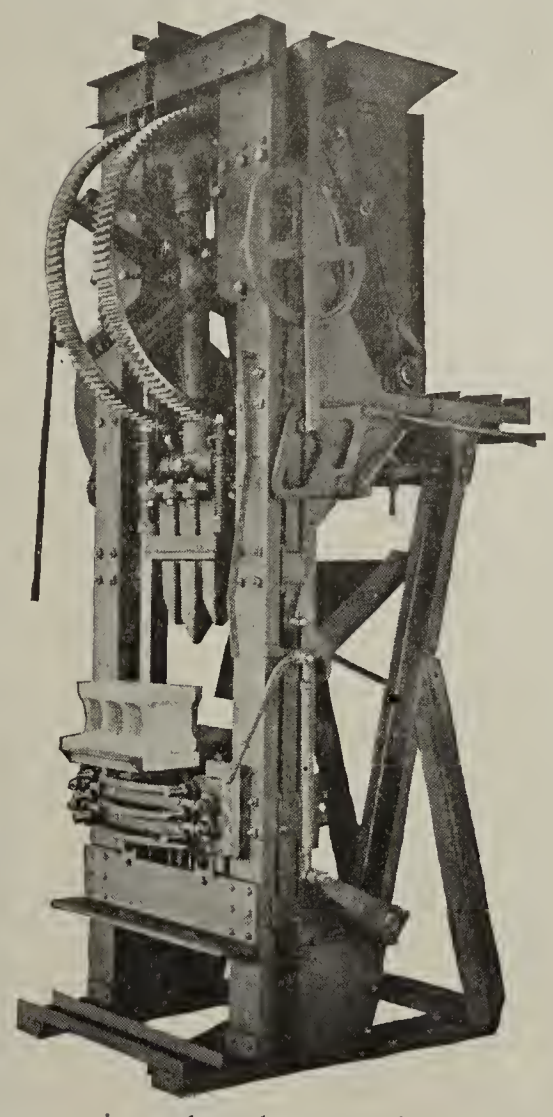
The American Concrete Institute is growing rapidly. It was reported that the membership at the end of the convention had reached 873 and that the finances were satisfactory. William P. Anderson, of the Ferro-Concrete Construction Co., of Cincinnati, was elected president. Harvey Whipple, Friesma Building, Detroit, Mich., is secretary.

Large Production Automatic Block Machine, at Minimum Cost

The Kent Machine Company, Kent, Ohio, which recently acquired the sole manufacturing and sales rights to the Post Economy Punch, presents to the readers of CEMENT AND ENGINEERING NEWS a few details showing the new construction of this machine and its adaptation to the making of concrete blocks.

The illustration herewith shows the sturdy frame which the machine now has and also illustrates the rigid and rugged manner in which this frame is put together. It will be noticed that most of the parts are hot riveted together, heavy gusset plates being used on the corners. Where rivets are not employed, ream bolts are used in order that there may be no vibration or give under the enormous pressure given by this machine. The frame is put together like a big bridge construction and the design is sturdy enough to withstand all shocks which the machine may have.

The mold box is now composed of heavy steel castings and is so rigid and firm that there is no question relative to the springing of the box under the tremendous pressure given by the tapering wedges as they pack the block.



The cut shown herewith gives a general idea of the size of the machine and the stability and rigidity of the entire mechanism.

The Kent Machine Company report that great interest is being manifested in this automatic machine by block manufacturers who are anxious to secure a large production at minimum cost.

New Book American Homes

"American Homes," 160 pp., 7½x10¾, paper, $1; American Architectural Service, 219 Fifth Street, South, Minneapolis. This is an exceedingly well-printed book, with clear illustrations reproduced on a good quality of paper. Besides the usual photographs and sketch-plans, the book contains some good general advice to prospective builders on plumbing, methods of lighting, location of the house, etc. Designs for two-story houses, cottages, bungalows, duplex houses, four-family flat-buildings, one- and two-car garages, and a few photographs of modern barns are presented. Working drawings are obtainable for the designs shown, consisting of floor plans for all stories, drawn to ¼-inch scale, with all necessary notes and figure dimensions plainly marked on each plan, four elevations and sections showing the method of construction, size of timbers, as well as all necessary interior and exterior details, with full explanations of same; also original set of type-written specifications, embracing all materials and labor required for the completion of building.

Handling Material Successfully in Cramped Quarters

How we solved our problem of handling a diversified line of material in a comparatively small yard, By F. Hurlbut Company, Green Bay, Wis.

Our yard is situated in the center of the town of Green Bay, Wis., on the Fox River. As ground space is at a premium, it is necessary to double-deck the bulky material we handle—consisting of several kinds of coal, crushed stone, crushed gravel and sand—as much as possible.

The yard is so arranged that we have storage space along the river, under a steel overhead electrically operated clamshell bridge. Back of this bridge, parallel with the river, we have a series of storage hoppers over the team road into the yard. The bridge is busy day and night handling principally coal into cars and hoppers; some of the crushed stone, gravel and sand is piled on the dock with self-unloaders and must be handled to trucks and hoppers with other equipment. We also receive considerable gravel, crushed stone and sand by car, which must be handled quickly and cheaply.

To do this work, we installed a Crawler Crane. This is a locomotive crane on crawlers and has a one cubic yard clamshell bucket capacity with a 35-foot boom. This machine has proved very satisfactory. It moves and steers easily, runs all over the yard without tracks, unloads and stores material, loads trucks and hoppers, and also cars anywhere in the yard—in fact it has enabled us to use yard space which heretofore we could not reach with our ordinary equipment consisting of the bridge and track locomotive cranes.

The Crawler Crane unloads a string of cars from alongside. We usually handle from 10 to 15 cars daily with its help. After unloading to a four or six foot height, this machine climbs on the piles and double-decks the material. It has been of the greatest help in enabling us to successfully handle our bulk material in so restricted a yard space. This machine has other advantages—it is gas driven, one-man, operated, quicker than steam cranes, and no time is lost in starting and stopping or raising steam and keeping it up. It is cheap on fuel and can be sent anywhere in town where quantities of material are awaiting quick handling.

As we work on the principle of avoiding hand labor wherever possible, having found that it pays in the end, we effect a considerable saving by the use of this machine. We are convinced that a crane of this kind is as important in a material yard for unloading and loading, as trucks are for delivery of materials.

Concrete Pipe Machine

All Automatic Machine Co., 1740 E Twelfth street, Cleveland, O., is introducing on the American market the All Automatic concrete pipe machine which has proved so successful in Europe. This machine is entirely automatic and is continuous in operation. It is a one man machine with large capacity. A 2 h. p. motor furnishes all the power required. Pipes are produced in any diameter from 3 to 24 ins. and in standard lengths up to 40 ins. One of the great advantages of this machine is the fact that by merely pulling a small lever the tamping device is changed from working on the straight pipe to the bell end. Machine weighs about 3,000 lbs. and occupies a space 8 by 10 by 11 ft. It can now be operated with an extremely low maintenace cost. Further information may be obtained from the company.

Caterpillar crane with clam shell bucket for handling material

Unwashed and Ungraded River Gravel Makes Good Concrete

Sir—In developing a new coal mine for the Spruce River Coal Co., at Jeffrey, W. Va., it was necessary to build several miles of standard-gauge railroad which crossed two streams requiring bridges. These bridges were of the deck type, with wooden stringers resting on concrete abutments and piers, calling for some 400 cu. yd. of materials.

Although close to the railroad the cost of shipping in sand and gravel for this work was rather expensive. After some investigation it was decided to use gravel and sand from the creek bed at the site of the work.

This portion of West Virginia is quite mountainous and considerable sandstone abounds. The streams are typical mountain streams, almost dry in continued hot weather but rising to rushing torrents after a few hours of heavy rain. Many gravel bars and riffles have been formed by these streams and the materials are excellent if they were cleaned and graded. However considerable loam is mixed with the gravel and in places yellow clay. The stones are of all sizes from ones larger than one's hand on down.

This gravel was excavated and hauled to the site of the work and dumped in piles. When wet it seemed very dirty but upon drying out had a light grey color and the sand seemed sharp although mixed with loam. This material was mixed in a gasoline mixer and proportioned three bags of cement to one yard of concrete. It was poured rather wet and openings were left at intervals in the forms to allow the scum to drain off.

The first few days after the removal of the forms the concrete did not seem to harden as rapidly as it should. The loam seemed to have worked to the face of the forms and made the concrete look dirty and ragged. It has now been completed about six months and is as hard as stone. The dirty, ragged appearance has entirely disappeared and the color is good.

In connection with our new tipple construction we have constructed two retaining walls, one foundation wall and about 75 or 80 piers of the same material. These all appear to be excellent and are of good color and very hard. In the retaining walls we used a great deal of loose rock as well, throwing it into the forms as the concrete was poured. The rocks were sandstone of all shapes and sizes from the size of a football down. We had occasion to drill several holes in one of these walls several days after it was completed and we found it to be very hard, but tough rather than brittle.

J. S. KENNEDY,
Engineer, Spruce River Coal Co.
Ramage, W. Va.

Limestone Crusher Dust and Poor Concrete

In a recent article concerning the failure of concrete building in which the aggregate was limestone with a considerable percentage of crusher dust, reminds me that two experiences of this kind have come to my personal attention.

The first case was that of some concrete piers for a steel truss bridge over the Kankakee River in Indiana. After a lapse of about one year, the concrete of these piers was still soft and samples could be taken out with a heavy trowel. The remains of the pile of aggregate showed the concrete had been made with soft limestone containing crusher dust. The coping on the abutment, which was made with sand aggregate, was hard and firm. The concrete in the piers of a railroad bridge over the Kankakee River very near the highway bridge was in good condition. Samples of the aggregate containing different percentages of crusher dust were taken to the laboratory and made into the usual tension and compression specimens. These under test showed a high strength.

When the soldiers were being taught the art of concreting at Purdue University during the war, they had two short sections of retaining wall to build, (a) with sand and gravel aggregate, and (b) with soft limestone aggregate containing unusual proportions of crusher dust. In both cases the cement, weather conditions, workmanship, amount of water, etc., were the same. Section (a) is excellent concrete; section (b) has not hardened and samples can be taken out with a stiff trowel. Laboratory investigations fail to produce data which would be predictive of the condition of this concrete which cannot be charged to "balling-up." The entire wall (b) is of the same character.

I am reminded that tests of reinforced concrete beams containing crusher dust made at Purdue University in 1901 showed excellent strength.

I have put this problem up to expert cement chemists without an answer. It would appear that the use of soft limestone aggregate with crusher dust is attended with grave dangers. W. K. Hatt, Director, Advisory Board of Highway Research, Washington, D. C.

The Metric System

Upon reading your editorial in CEMENT AND ENGINEERING NEWS, January, 1922 issue, advocating "THE METRIC SYSTEM" I feel impelled to take issue with you on the questions of practicability and desirability of the Metric System as a satisfactory substitute for the English System of weights and measures.

In the first place, I do not agree that it is "generally admitted by the majority of intelligent persons in this counry that the Metric System is a much simpler and better system." I feel reasonably safe in asserting that the "majority" have scarcely given the matter a thought. I think it is perhaps true that scientists, manufacturers of fine instruments, teachers, and certain associations organized for the purpose of spreading Metric propaganda, favor the Metric System, but the scientific field is small and its methods and products neither fixed nor standardized.

Numerically the proponents of the Metric System in this country would probably represent as much as one-half of one per cent of the total population.

Your statement that the Metric System "is in use in everyday life in all civilized countries excepting America, Great Britain and its colonies" is both misleading and incorrect, misleading in that it leaves the impression that those countries are using it to the exclusion of any other system, and incorrect, in that the Metric System predominates in only 37 countries out of 77, being countries too, which made the change to secure uniformity, whereas this country now enjoys uniformity, but would lose it if we should change our system.

While the Metric System has its advantages in certain directions it is not superior, nor even equal to,

the English System, and to substitute it in the English-speaking countries of the United States and Great Britain would be, in the light of the experience of other nations, extremely unfortunate, to my way of thinking.

Take, for example, the case of France. France seems to have been the first country to adopt the Metric System, having established it by decree in 1793. The work of putting the system into general effect proceeded slowly until 1840, during which period, particularly 1812-1837, there was much confusion and fraud. On January 1, 1840, a new decree was issued declaring all other weights and measures forbidden, and although France has been trying for over a hundred years to establish the Metric System the old units are still used to some extent.

The experience in France has been repeated, with varying degrees, in the 37 countries (out of 77) in which the Metric System predominates.

I think it may be safely said that with the exception of Great Britain, no other nation in the world enjoys such absolute uniformity as to weights and measures as does the United States. "If efficiency is to be the slogan" then let us stick to our present blessing instead of bringing the curse of confusion upon the heads of the next five generations—plus. Sincerely, W. P. Sabin, General Auditor and Ass't to President, Ash Grove Lime and Portland Cement Co., Kansas City, Mo.

Detecting Flash Setting Cements

Sir—We have read the foregoing article by C. L. Jenkin on the setting time of cement with appreciative interest as it touches on a feature of the testing and use of cement which we think deserves far more serious attention than it usually receives.

In our cement testing department we have frequently noted the conditions described by Mr. Jenkin and have come to the conclusion that some cements have a latent tendency to flash setting which is difficult to detect by the conventional test for setting time. We tried various means of revealing a tendency to flash setting which the cement test did not disclose and found three methods which apparently were of equal effectiveness. We sometimes heated the cement and water to 100 deg. F., while on other occasions a cement that was under suspicion would be exposed to the air in a thin layer for 24 hours. The third expedient consisted in allowing the cement, after adding the water for the setting time determination, to remain undisturbed for five minutes before mixing into a paste. If a tendency to flash setting exists in cement it is usually impossible to mix it to a paste if allowed to stand for five minutes after adding the water. The two methods first mentioned are frequently effective in so exaggerating the tendency to flash setting as to make it clearly apparent by the cement test.

Curious beliefs spring up in the trade concerning cements. On a recent day we heard a certain brand of cement bitterly criticised by one contractor for slowness in hardening and by another contractor for setting so quickly as to present difficulty in getting the concrete into the forms before setting occurred. This apparent inconsistency is probably due to the fact that the cement in question almost always tends to become flash setting or else has the ability to develop what might be termed a false initial set. The slow hardening complaint was probably due to the fact that the set was broken during the mixing with resultant slow hardening while the party who found that it hardened too quickly was probably mixing too short a time to break the set so that setting commenced in the buggies and chutes.

While for many purposes the presence of a flash setting tendency in cement may be ignored, it is of vital importance that cement for concrete floors, sidewalks, roads and many other uses be normal as to setting time.

Philadelphia, Pa. E. L. Conwell,
November 1. Pres., E. L. Conwell & Co., Inc.

A Study of the Effect of Moisture Content Upon the Expansion and Contraction of Plain and Reinforced Concrete

While the properties of concrete have been investigated for many years, attention has largely been given to considerations of strength alone. Aside from the action of direct load, deformations are produced in concrete by changes in temperature and in moisture content. With reference to temperature changes in reinforced concrete, it is well known that concrete has practically the same coefficient of expansion as steel, so that the two materials contract or expand together. Moisture content, on the other hand, has the undesirable property of affecting concrete alone. Concrete, like wood, clay, and some other materials, expands when it absorbs moisture, and contracts when it is dried. Steel has no such action.

Bulletin No. 126 of the Engineering Experiment Station of the University of Illinois, entitled "A Study of the Effect of Moisture Content upon the Expansion and Contraction of Plain and Reinforced Concrete," contains some of the results of experiments made by Torata Matsumoto, a graduate student in Theoretical and Applied Mechanics at the University of Illinois, in 1918. Owing to his years of experience as an engineer on harbor works on the Island of Formosa, he was particularly interested in the question of the durability of concrete exposed to sea air and to the conditions found in a tropical climate. It is felt, however, that the results obtained apply to our ordinary conditions and may have many practical applications.

Copies of this Bulletin No. 126 may be had without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

New Book, Concrete Products

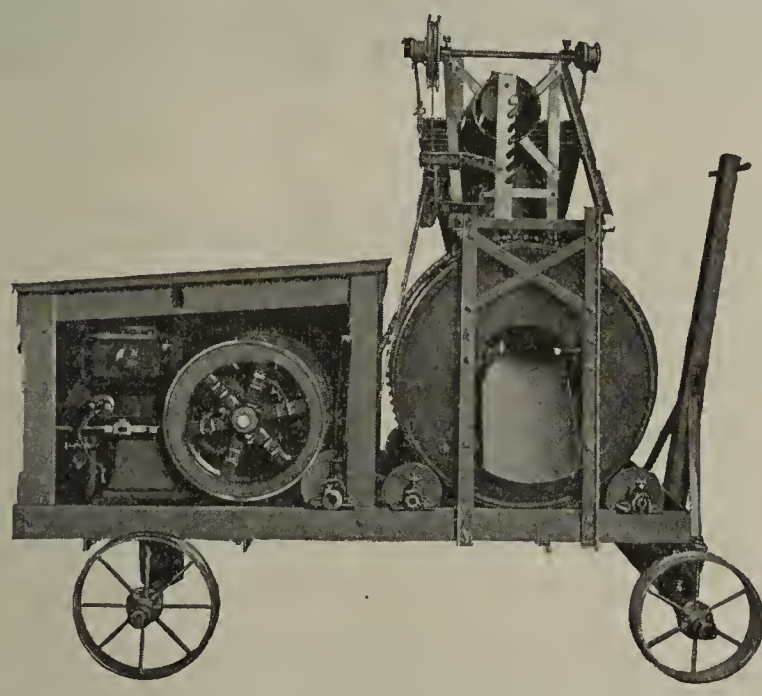
International Trade Press, Wallace R. Harris, editor, 547 Monadnock Block, Chicago, have recently published a new book entitled "Concrete Products, Their Manufacture and Use." This is a valuable book, containing 238 pages of authoritative, dependable information compiled by men who are in constant touch with every detail of the concrete products field. It is written in a non-technical, interesting style and covers every subject from concrete products as a business to the exhibition of concrete products. Price $2.50.

The Kent Junior Batch Mixer

The Kent Machine Company, Kent, Ohio, has recently added to its line of "Red Line Products" a batch mixed which they have named the "Kent Junior Batch Mixer." This mixer has been manufactured for the past ten years by the F. H. Clarke Manufacturing Company, of Cleveland, Ohio, under the name of the "Kelly Mixer," and the Kent Machine Company has purchased all right, title and interest together with stock of material on hand from the F. H. Clarke Manufacturing Company.

This new addition to the Kent "Red Line Products" line is a one-bag size mixer, having a capacity of from six to eight and one-half cubic yards of loose material, depending upon the size of aggregates used.

It has a very substantial truck and frame, designed to stand not only the use which a concrete mixer receives, but also the abuse which is oftentimes heaped upon a machine of this character by those engaged in contracting work. The axles are large and securely attached to the frame, the wheels having 3-inch wide tires, with gauge to suit that of the standard wagon. The frame itself is made of heavy steel channels, thoroughly braced crosswise and diagonally by heavy angles and bars and is rigidly fastened at the corners. The machine is 8½ feet long and 5½ feet wide over all.



The drum is made of heavy steel plates with iron heads and the mixing blades or scoops on the inside of the drum are fastened to the drum in such a way that replacement of broken and worn parts may be easily made with only the ordinary wrench as a tool.

The drum itself is carried on four solid trunion wheels, the surfaces of which have been chilled and which revolve in bearings of substantial design which are fitted with bronze bushings. This enables replacements of worn parts to be made by the purchase of simply a small bushing.

The sprockets and chain used in transmitting the power from the engine to the intermediate shaft and from the intermediate shaft to the drum are heavy in design and are made for long wear. The chain gives a flexible connection between the engine and the drums so that neither vibration, misalignment or wear can affect it.

The machine is furnished with a standard hopper or with an automatic loader. The standard hopper is made of heavy sheet steel, reinforced with steel angles and bars and supported on a heavy steel angle iron frame. It is ample in size and convenient for loading from wheelbarrow or by shovel.

The discharge chute is also of heavy sheet steel, hung on a rigid angle iron frame. When not discharging this chute locks itself automatically in position. To dump it is only necessary to release a small catch and push the handle in a horizontal position. Any quantity may be discharged, as the discharge stops immediately upon raising the chute.

The power loading device is heavy and substantial and is supported by a rigid steel frame which is more than ample to carry all loads and strains. The skip is of ample size and is so designed that there is nothing to interfere with the free dumping of wheelbarrows. The angle of the chute, when raised, is such that materials flow readily into the drop. The raising, lowering or holding of the skip is all controlled by one lever located on the discharge side of the machine. In fact, the machine may be entirely controlled by a man standing in one position adjacent to the delivery chute. The water tank is so designed that it may be simply and rapidly adjusted, so that any amount of water may be used for a batch. The same amount of water will be supplied for every batch, due to the fact that there are no floats or internal mechanism that may get out of order. The flow of the water is controlled by a lever on the discharge side of the mixer, which is within easy reach of the operator.

As stated before, the operation of the machine is controlled by the operator standing by his engine on the discharge side of the machine. In this position he is able to observe at all times the running of the engine, while he may raise or lower the power loading chute, he can control the action of the water and operate the discharge chute. This may all be accomplished without moving from a position by the engine, which makes this a one-man operating device.

PRICES OF PORTLAND CEMENT IN 1921

Preliminary estimates made by the United States Geological Survey from reports of representative producers of portland cement show that the average factory price per barrel of portland cement excluding, cost of container, in the United States in 1921 was approximately $1.87.

The prices by districts were as follows:

District	Average factory price per barrel in 1921
Eastern Pennsylvania and New Jersey	$1.72
New York	1.90
Michigan and northeastern Indiana	1.85
Illinois and remainder of Indiana	1.68
Western Pennsylvania and Ohio	1.73
Maryland, Kentucky, Virginia, and West Virginia	1.83
Alabama, Tennessee, and Georgia	1.94
Iowa, Minnesota, and Missouri	1.77
Kansas, Nebraska, Oklahoma, and Texas	2.15
Colorado and Utah	2.33
California	2.35
Washington, Montana, and Oregon	2.51

The average net factory price received per barrel for the whole country in 1920, as shown by reports received from all producers, was $2.02.

A general view of the plant of The Luckey Lir

Modern Plant for Manufacturing Finished Lime

Further development of Ohio's famous dolomitic limestone deposits is evidenced by the recently completed Luckey Lime and Supply Company's new plant at Luckey, Ohio.

This interesting plant, which consists of six kilns, is designed to produce 150 tons of hydrated finishing lime per day. Provision has been made for duplicating this output when the demand requires.

Concrete and steel were used exclusively in the construction of the plant.

In designing this plant everything possible has been taken into consideration by the engineers to eliminate labor with the result that it can be operated with less labor than any other plant of like capacity.

Limestone.

Stone used in making lime in this plant has the following chemical analysis:

	Per cent.
Calcium carbonate	54.930
Magnesium carbonate	45.020
Iron	.025
Silicon	.025
Total	100.000

This grade of stone will make a very high grade finishing lime. There is an unlimited supply of stone which is available by removing a very small overburden. The blasting is done with well drills. Holes are usually drilled about 8 ft. apart, in both directions, and staggered. The first shot put off in this quarry loosened up about 8,000 tons of rock. The tracks from the top of the kilns run directly down into the quarry and after the cars are loaded they are hauled up to the tipple by a hoist system. They are fastened to steel cables which pass over the tipple to the farthest end of the kilns over a series of sheaves to the electric hoists which are at the furthest end of the kilns and are on a level with the firing floor. The car hoists are operated with levers which control the car at will and start and stop or reverse the car over any kilns desired. This system of operation is controlled by one man on top of the kilns.

In connection with this phase of the work a stone crushing plant, having a capacity of 200 tons of crushed stone per day, is operated. All stone which is too fine when it comes from the quarry for economical burning, is utilized in the crushing plant.

Cars of stone, when discharged, dump directly into the cribbing at the top of the kilns. This cribbing is for storage purposes and is continuous over the entire battery of six kilns, thus insuring a constant and

Incline leading from quarry to kilns.

even supply of stone at all times. A double track system is used over the kilns, allowing the stone to be distributed as evenly as possible. Cars, which are of the rocker dump type and dumped alternately from either side of the kilns, which aid, still further, the even distribution of the stone. As the stone settles in the kilns, it is gradually and evenly drawn from the cribbing storage by gravity into the kilns, which insures at all times a full kiln, and guarantees a maximum output of lime, with the best fuel ratio.

In the kilns proper, just below the described cribbing, the heat varies from a very small degree at the top, to about 2000 deg. F. at the eyes, or where the heat enters the kiln. When the stone passes into the kiln from the cribbing, it is first subjected to a mild heat, which causes the stone to sweat. As the stone worked down through the kiln, the heat naturally increases, which causes the natural gases in the stone to

ly Co. It is constructed of steel and concrete.

be thrown off. The elimination of the gases leaves the stone very porous and makes it more susceptible to the greater heat it encounters as it passed down through the kiln. This permits the stone to calcine in a much shorter time than it would otherwise and also improves the quality of the lime.

Each of these six kilns have two external furnaces built as part of the steel shell and lined as a unit with the kiln. The furnaces are hand fired and are fitted with shaking grates, steam being injected under the grates.

There are many improved features on these kilns, which are the built kilns and lining. The kilns have a capacity of 150 tons of lime daily. The arrangement of the plant so that an additional six kilns can be added, making a continuous battery of 12 kilns, of which the capacity will be as stated, 300 tons daily, for which the machinery described is sufficient to take care of. The kilns are designed along scientific lines so as to produce the best quality of lime with the most economical operating expense.

The Coolers.

After the stone has been calcined it passes the eyes or port-holes in the kiln into what is known as the cooler. These coolers are built in such shape and of sufficient size to allow the lime to cool by radiation to a temperature of from 100 to 200 deg. F. This is very necessary in the manufacture of a good grade of lime, for if the lime should be drawn hotter than this, a certain percentage would recrystalize. The recrystalized lime would spoil to a certain extent the balance of the lime during the hydration process. Another advantage of these large coolers is that if the lime were drawn too hot, much of the heat would be wasted, which is now used over again in the kiln. This not only saves fuel but makes a higher grade of lime.

Pneumatic Draw Shears.

One of the many prominent features of this plant is the new type of draw shears and this is the first plant where anything of this nature has been used. The special feature of these draw-shears is that they are pneumatically operated. Previously, all draw-shears have been operated by hand arrangements of various descriptions, none of which have given complete satisfaction. The draw-shears are operated by a very slight movement of a lever and this is the quickest method of drawing a kiln that has ever been devised. The draw-shears open up their entire width, thus allowing the lime around the outer edges of the cooler to drop out as quickly as that in the center of the cooler.

One of the many objections to hand operated draw-shears is the length of time it is necessary for the cooler to remain open, thus retarding the fire. With the air operated shears, since they open to their full capacity and the entire width of the cooler, they are opened and closed again as quickly as they can be operated, which has practically no effect on the fires.

Concrete construction equipment used in building plant. Leschen plow steel and Hercules wire rope used in its construction.

Draw-shears for the entire battery of six kilns can easily be handled by one man.

Handling Coal.

In this plant coal is handled very economically. The system receives the coal from the cars, crushes same and stores it until needed. The system is so designed that it also takes coal from storage and delivers it on the firing floor in front of each fire box in a convenient location for shoveling into the furnace.

Hydration of Lime.

After the lime is drawn from the coolers it is picked up and discharged into an apron conveyor. This conveyor delivers to a Williams hammer mill which crushes the lime to ¼-in. and smaller. From the ham-

mer mill the ground lime is conveyed by means of a bucket elevator and screw conveyor to the enormous lime storage bin, which has a capacity of 1,500 tons of ground lime. The storage bin is about 85 ft. high. This storage is sufficient to hold the entire output of the plant for a period of 10 days or longer, and its capacity will be of great value in case of car shortage or a tie-up from any cause. From the storage tank the ground lime is conveyed by screw conveyor to the hydrators.

Hydrators are of the Clyde batch type and are discharged from a small scale bunker, into which has been delivered a predetermined number of pounds of ground lime. At the time that the lime is put into the hydrators a sufficient quantity of water is added to make the hydrate.

Two Clyde hydrators take care of the capacity of 150 tons a day. From the hydrators the lime is discharged into hoppers, underneath which is a screw conveyor which delivers the lime to an elevator and then to the seasoning tanks. These tanks have a capacity of 250 tons each and there are two of them. The hydrated lime is stored in these tanks for a period of 24 to 36 hours, which gives it an opportunity to thoroughly season and any lime which does not become thoroughly hydrated while in the hydrators will become completely hydrated while in the seasoning tanks.

Through Raymond Mills.

After the lime has been in the seasoning tanks for the proper length of time it is drawn from these tanks and run through the Raymond finishing mills, which separate all the impurities. Any small core or pieces of poorly burnt lime will be removed by the Raymond mills.

Passing the finishing mills, the lime, after being bagged, is ready for market. It is taken from the finishing mills by vacuum to the bunkers over the bagging machines, there being two, four-valve Bates machines. The paper bag is simply placed on the cradle of the machine with the opening over the spindle, the machines weigh out 50 lbs. of hydrate into each bag. The lime is then ready to be shipped and can be trucked directly from the bagging machines to the cars.

Collection of Fine Dust.

Fine dust, which ordinarily is wasted by being blown over the roofs of buildings and the surrounding country, in this plant is reclaimed by a Raymond tubular dust collector. Aside from the saving in labor, usually required to keep the roof reasonably free from dust, these collectors reclaim this very fine lime dust and draw it down to the shipping floor, where it is put into bags and finds a ready market for purposes where an extra fine grade of hydrated lime is required.

The combined capacity of the ground lime bin, the two seasoning tanks and the storage space for the finished product, is sufficient to allow the plant to run full force for a period of about 18 days, in case of car shortage, without resorting to slow firing of the kilns. Slow firing spoils the product and every possible arrangement has been made to make this unnecessary.

Quarry.

Quarry from which stone for the lime kilns is secured was opened about 1 year ago. The opening blast loosened about 8,000 tons of stone. This blast was set off July 20, 1920. Holes were drilled with a clipper well drill, there being 89 holes each 5⅝-ins. in diameter, spaced 8 ft. apart in both directions and staggered. Each of these holes was approximately 17 ft. deep and loaded with 60 lbs. of Du Pont 60 per cent gelatine dynamite, making in all about 5,340 lbs. The shot was considered one of the most successful ever made, using the big hole method of "opening up."

Stripping on the entire 61 acres of land ranges from surface outcropping to a depth of not exceeding several feet.

Loading.

In he quarry are placed several 36-in. gauge tracks which lead to a central point. Trucks with 1 cu. yd. bottom dump buckets are placed on the tracks and are loaded with stone by hand. The buckets of stone are ushed along the tracks and a stiff leg derrick, in connection with the steam hoist, lifts the bucket of stone from the truck and dumps it into the hopper located on the ground level and directly over a 36-in. gauge track in line with the crusher tipple. On this track is placed a 2 cu. yd. rocker dump car, which is loaded from hopper storage by means of opening a slide gate at the bottom of the hopper.

This arrangement for loading, together with the stiff leg derrick and buckets in the quarry, are employed temporarily, it being planned to send the rocker dump cars direct to the quarry. A centrifugal pump keeps the quarry dry.

Cars are loaded from loading hopper with one man stone and under. Cars are hoisted by means of an electric hoist up a 20 deg. incline. Hoist is operated by long levers which are located on the crusher platform above the hoist and at a location where the hoist man can watch the car of stone come up the incline The car is dumped by the hoist man onto the crusher platform where it is fed into a gyratory crusher. The hoist control is located in a small house on the level with the crushing platform, which house also provides room for all the electrical control for the quarry machinery, crusher, elevator, screen, hoist, etc., so that all equipment can be started and stopped from a central point.

In connection with the modern lime plant, this concern also operates a stone crushing plant which is modern in every respect.

This plant produces from 200 to 250 tons of crushed stone per day of various sizes, which is used for concrete aggregate and road work. All stone which comes from the quarry too small for economical burning in the kilns is put through the crushing plant, and not only makes a profitable side line to the main plant, but also rids the quarry of spalls.

The spalls are placed into two yard dump cars in the quarry and hauled up the tipple by the hoist method. The crusher in this plant is the gyratory type and is set for a product of 2 inches and under, all sizes of which find a ready market. The crusher discharges into a continuous bucket elevator which feeds through a spout into the revolving screen. This revolving screen separates the stone into three sizes and return the oversize stone back to the gyratory crusher for recrushing. Finding a large market for screenings, provisions are made to recrush the ½-inch product in order to make a larger supply of fines.

After the stone is crushed and screened it goes into large concrete storage bins, there being three of these bins, one for each size product. Each bin will hold about two carloads of stone, making a storage capacity of six carloads. The product can be loaded direct from these bins into cars, trucks or wagons by gravity.

All machinery, screens and other equipment is entirely enclosed by buildings and all machinery and every part of the crusher house is easily accessible by stairs and ladders.

As is the case with the main plant, the crushing plant is operated as economically, and with as little labor as possible.

Fig. 1. Early stage of excavating at Thorsberg, Minn. pit of Wahpetan Gravel & Sand Co.

A Minnesota Gravel Plant

For producing 5,000 to 10,000 tons of clear graded material per month, a plant that appears to be quite a model of economy is operated at Thorsborg, Minnesota, by the Wahpeton Gravel & Sand Company of Wahpeton, North Dakota.

The property is level and has an area of 160 acres. The depth is estimated at 50 to 60 feet, more than three-fourths of the material lying below water level. These ground conditions are ideal for the Sauerman Dragline Cableway Excavator which is employed for digging, conveying and elevating the sand and gravel from the pit direct to the receiving hopper on top of the plant.

This cableway has a span of 500 feet, is equipped with a 1 cu. yd. bucket and is operated by a 50 H.P. double drum electric hoist. Instead of the usual built-up timber mast, a structural steel mast, 80 feet high,

Fig. 2. View of pit after Sauerman cableway had been operating several months.

supports the head end of the cableway. The operating cables lead through the center of the mast down to the ground and then pass through guide blocks out to the hoist, instead of leading at a 45 degree angle from the top of the mast direct to the hoist drums as is the practice when a wooden mast is used.

The plant has a gyratory crusher and screens that separate the sand and gravel into three sizes. The capacity of the washery is approximately 250 tons per day, but it is the intention to enlarge the plant as soon as the demand warrants, the 1 cu. yd. Sauerman Cableway being capable of delivering at least 500 tons per day when operating at maximum speed on its present span.

The view of the entire pit (Fig. 2) is especially interesting because it illustrates a method of anchoring the outboard end of the cableway that permits excavating within a few feet of the extreme end of the track cable. The "A" frame that supports the tail end of the cableway is easily shifted, hence it is only a matter of minutes to change the line of operation of the bucket.

Repaired by Welding

The repairing by means of welding the 4¾-inch diameter axle of a road roller operated by the New Jersey Construction Co., Hackensack, N. J., which had become fractured at the location of one of the spiders which are bolted to the sides of the wheel hubs and are keyed to the axle, was successfully accomplished recently. In order to avoid having to machine off the collar of the weld, which would have been necessary to allow the spider to fit over the weld, the end of the axle on this side was cut off near the middle of the shaft and a new over-size billet 30 inches long was then welded on and machined down to 4¾-in. dia. In this case the welded collar did not interfere with anything and did not have to be machined off. The spider on this side, which had been removed before welding, was replaced (after a new keyway had been cut in the machined billet) by a new spider. This operation was performed by first heating the new spider and shrinking it on. The axle was again installed under the roller which was then placed in operation as usual.

Sand-Lime Brick

By Jefferson Middleton*

The production of sand-lime brick in 1920 continued to increase from the low output of 1918. Though the quantity was smaller than in any other year since 1911 (except 1918 and 1919) the value was the highest recorded. The lag in the resumption of building operations, on account of high costs, is undoubtedly responsible for the slow recovery of the sand-lime brick industry. With the renewal of building activity the output of this product should increase rapidly, as it seems to be firmly established in public favor in many localities. The trade was generally reported good during the first nine months of 1920, after which the demand fell off very considerably. This industry was also handicapped by the shortage and inefficiency of labor and by difficulties of transportation, which not only delayed the shipment of brick but so delayed the receipt of materials in some localities as to affect production.

The quantity of brick produced in 1920 was 16 per cent greater than in 1919, and 73 per cent greater than in 1918, but 9 per cent less than in 1917 and 25 per cent less than in 1916. The value exceeded that of 1919 by 46 per cent, that of 1918 by 182 per cent, that of 1917 by 75 per cent, and that of 1916 by 69 per cent. Compared with 1913, the quantity in 1920 decreased 10 per cent and the value increased 101 per cent.

The number of operators (37) reporting sales in 1920 was the smallest since 1903, except in 1919. The average value of the sales per active operator in 1920 was $67,305, compared with $48,719 in 1919, $21,046 in 1918, and $30,220 in 1917. The average output per active operator was 4,588,000 brick in 1920, 4,198,000 in 1919, 2,343,000 in 1918 ,and 3,990,000 in 1917.

Seventeen states reported the production of sand-lime brick in 1920, an increase of one—Idaho dropped out and California and Washington reappeared in the list of producers. Ten of the States that reported in both 1919 and 1920 increased in output and value; these were Florida, Massachusetts, Minnesota, New York, Ohio, Pennsylvania, South Dakota, Texas, and Wisconsin, and the District of Columbia. The quantity decreased in Georgia, Indiana, and Michigan, but the value increased, and both quantity and value decreased in Louisiana and North Dakota. In 1920, as for many years, Michigan was the leading State in marketing sand-lime brick and reported 23 per cent of the total quantity and 26 per cent of the total value, a decrease of 7 per cent in quantity, but an increase of 26 per cent in value, compared with 1919. Minnesota ranked second in output, reporting 15 per cent of the quantity and 12 per cent of the value, an increase of 6 per cent in quantity and 21 per cent in value. Wisconsin was third in quantity and fourth in value; Florida was fourth in quantity and third in value; New York was fifth in both quantity and value. These first five States, rated by production, reported 64 per cent of the quantity and 63 per cent of the value.

About 99 per cent of the output was marketed as common brick, in which there was an increase of 15 per cent in quantity and 45 per cent in value, compared with 1919. The average price per thousand for common brick in 1920 was $14.61, compared with $11.58 in 1919, $8.94 in 1918, and $7.54 in 1917. For face brick the average price was $19.48 in 1920, compared with $13.29 in 1919, $11.35 in 1918, and $9.36 in 1917.

*Written for U. S. Geological Survey.

SAND-LIME BRICK MARKETED IN THE UNITED STATES
(1915-1920)

Year—	Number of operaters reporting sales	Quantity (thousands)	Value
1915	56	179,643	$1,135,104
1916	53	227,344	1,474,073
1917	47	187,546	1,420,330
1918	42	98,399	883,929
1919	35	146,947	1,705,163
1920	37	169,761	2,490,283

SAND LIME BRICK MARKETED IN THE UNITED STATES IN 1919 AND 1920.a

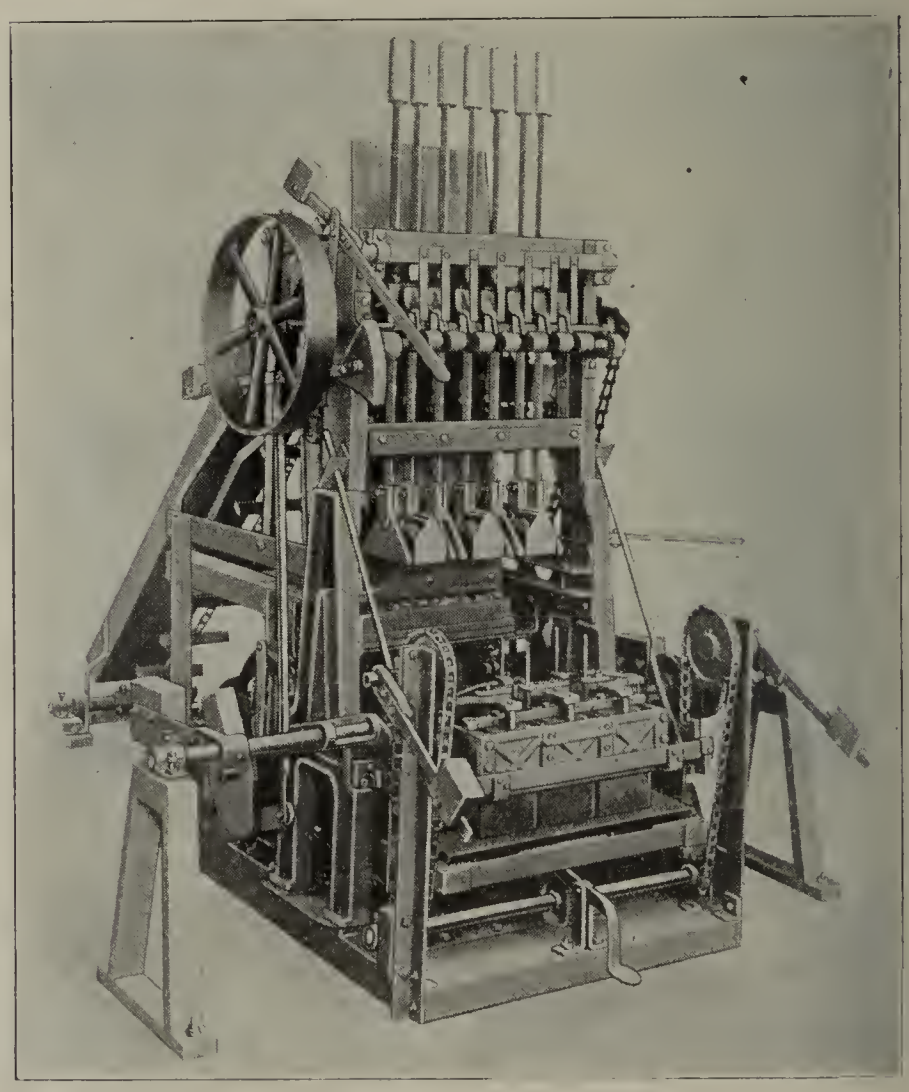
	1919		1920	
State—	Quantity (thousands)	Value	Quantity (thousands)	Value
Georgia	(b)	(b)	3,523	$ 55,528
Indiana	11,738	$ 108,089	10,034	128,013
Michigan	42,063	507,010	39,280	640,744
Minnesota	23,391	239,676	24,891	290,394
New York	10,958	159,399	11,294	176,114
North Dakota	(b)	(b)	30	500
Ohio	(b)	(b)	8,350	120,075
Pennsylvania	(b)	(b)	10,840	154,983
Texas	(b)	(b)	7,125	113,533
Wisconsin	(b)	(b)	17,157	215,988
Other States(c)	58,797	690,989	37,237	594,411
	146,947	$1,705,163	169,761	$2,490,283

(a) Common brick, except 1,670,000 face brick, valued at $22,197, in 1919, and 2,172,000, valued at $42,313, in 1920, made in each year in Florida, Indiana, Michigan and Wisconsin.
(b) Included under "Other States."
(c) 1919: District of Columbia, Florida, Georgia, Idaho, Louisiana, Massachusetts, North Dakota, Ohio, Pennsylvania, South Dakota, Texas, and Wisconsin; 1920, California, District of Columbia, Florida, Louisiana, Massachusetts, South Dakota, and Washington.

The "Ideal" Building Tile Machine

The new building tile machine recently put on the market by the Ideal Concrete Machinery Co., 1338 Monmouth St., Cincinnati, Ohio, is entirely automatic. It is only necessary to feed concrete into the conveyor at the back, and for the operators at the front to insert empty pallets and carry them away filled with tile. The arrangement of the machine is such that while an empty pallet is being exchanged for a full one, the machine is making the next batch of three tile.

That the design of Ideal Tile is correct is the consensus of opinion of men who are regarded as experts on concrete construction units. The tile are stripped



from the machine, which permits the use of a plastic mix, and also trowels the side walls.

The design of the machine permits tile of many dimensions to be made without the necessity of purchasing additional pallets. It is only necessary to make the changes in the mold box and tamp feet. The 5x8x 12-inches is considered the standard size. Tile 5x4x12-inches and 5x12x12-inches are also frequently used and can readily be made.

Operation of the Machine.

The conveyor which is located at the back of the machine and which is furnished as a part of the machine, receives the material direct from the mixer and conveys it into a material hopper. The feeding box which slides below the material hopper carries the concrete over the mold box where it is packed into place by the tampers. The feed box is then withdrawn scraping off the excess material and carrying this back under the material hopper, ready for the next charge. After the withdrawal of the feed box, the mold box swings into delivery position, bringing the bottom of the tile into contact with a wood pallet which is placed on a balanced table. The machine then strips the three tile onto the pallet, and at the same time pushes the pallet table down so that the tile are clear of the mold box, after which the mold box immediately swings back into place, the feed box comes forward and the machine starts on its next cycle. The full pallet is removed and an empty one substituted while the machine is tamping the next set of tile. At no time is it necessary to stop the machine, nor is there any pause in its operation while the tile are being removed.

The chief advantages of the Machine are as follows:

1. Absolutely automatic operation.
2. Entire elimination of cast iron stripper pallets, and the labor of placing these stripper pallets in the mold box.
3. Delivery of three tile on a single wood pallet.
4. The machine is so constructed that it does not have to be stopped or delayed for off-bearing of the tile.
5. The tile are made with the cores vertical, and are delivered with the thick side of the tile down, thus enabling a wet mix to be used.
6. The machine is adaptable to the manufacture of tile of various sizes without the purchase of additional pallets.
7. The machine is built exceedingly rigid and is set on a flat cast iron bed plate, upon which all parts are mounted. This keeps all parts in perfect alignment.

Limestone Quarries

Reports received by the United States Bureau of Mines from operators of limestone quarries throughout the country show that the industry employed 43,151 men in 1920 for an average of 259 days each, or 11,-154,653 shifts for all employees. These figures indicate increases as compared with 1919 of 8 per cent in the number of men employed, 12 per cent in total shifts worked, and 4 per cent in average working days per man. There was also, unfortunately, an increase in accidents, the reports showing that 96 men were killed and 5321 were injured; or 31 more deaths and 890 more nonfatal injuries than occurred the year before. The accident rate was 2.58 killed and 143.11 injured per thousand men empolyed (300-day workers). The corresponding rates for the previous year were 1.97 killed and 134.05 injured.

Men employed in the quarry pits proper, as distinguished from the crushers, or outside rock-dressing plants or mills, numbered 29,226, and worked 7,343,112 shifts, or 251 shifts per man. Those employed at the outside plants numbered 13,925, and they worked 3,811,541 shifts, or 274 shifts per man. Accidents inside the quarries caused 74 deaths and 3,590 nonfatal injuries, while those occurring outside the quarries resulted in 22 deaths and 1,731 injuries. The accident rates for the quarries proper were 3.02 killed and 146.67 injured per thousand employed, corresponding with rates of 2.24 killed and 136.44 injured for the previous year. For the "outside" works the rates were 1.73 killed and 136.25 injured, as compared with 1.40 killed and 129.04 injured in 1919.

Of the principal limestone-producing States, those showing decreases in accident rates during the past year were Michigan, Texas, West Virginia, Virginia, Maryland, Indiana, Missouri, Oklahoma and NewYork, while increased rates were noted for Kentucky, Pennsylvania, Illinois, Ohio and Alabama. Michigan showed the most notable reduction in the accident rate, the decrease in the number of injured being equivalent to 66 for every thousand men employed. The largest increase in the injury rate was in that for Kentucky, there being 52 more injuries for every thousand persons employed in 1920 than in the year before.

Considered by causes, practically all classes of injuries occurring inside the quarries were more numerous than in 1919, except in the case of falls or slides of rock or overburden, which declined from 349 to 322, and injuries resulting from burns, which fell from 70 in 1919 to 59 in 1920. The net increase in injuries occurring inside the quarries was 538. The net decrease in accidents at the plants outside the quarry pits was 352, and the only injuries showing a decrease were those caused by handling rock by hand, which fell from 83 to 40. Accidents from electricity at the outside works injured 26 persons, the same as in 1919.

Limestone quarries usually employ about 50 per cent of all quarry workers in the United States. The principal producing States are Pennsylvania, Ohio, Michigan, Illinois, Indiana, New York, West Virginia, Alabama, and Missouri.

Freight Rates on Cement

Murray M. Billings, appearing for the Portland Cement Association, before the Interstate Commerce Commission recommended a reduction of 25 per cent in the rates on cement. He asserted that every student of the transportation situation knew that every industry was bearing an excess burden of cost attributable to high freight rates. He said the cement industry did not wish to injure the railroads nor did the industry desire the railroads to injure it. He pointed to recent rejections of bids he made because the freight rates made the price too high.

"Probably the largest deterrent factor in reconstruction is the disproportionate and excess transportation burden," asserted B. L. Glover, appearing for cement interests, "with its underlying causes and collateral effects, which until reduced will continue to be a withering blight on commerce and industry."

Sales in South Africa

A pamphlet on "Commercial Possibilities of the Union of South Africa" has been issued by the National Foreign Trade Council, Hanover Square, New York, N. Y., and will be sent free of charge to any of our readers.

Stucco and Civic Pride

"Every stucco home properly constructed is a credit to the City of Lansing. That's why I prefer stucco to other types of construction. Stucco is pleasing, fire-resisting and permanent.

"Stucco construction has given the architect what steel once gave the engineer—a new, freer medium of expression. Like the modern office building, the stucco home has no prototype. It is different than wood, brick or stone. Its beauty—and utility—are distinctly new and original," writes Lee Black, architect, Lansing, Mich.

"Stucco is American. It is democratic. It marks the eradication of that line that separates the beautiful homes on the hill from the ugly hovels that flank the industrial districts. Stucco mansions and stucco bungalows both have their elements of beauty.

"And surely a complete street of stucco homes, enriched and softened like marble, is preferable to a street of painted and unpainted frame structures.

"Stucco provides a medium for uniform civic beauty. As gold is to commerce, so stucco is both the rich and poor man's medium of construction and measure of beauty—a medium that in time will predominate in every city."

One of the largest exclusive pebble dash stucco contractors in the country (E. W. Holmes Pebble Dash Co., Princeton, Ill.) offers at a moderate price specifications to make and apply pebble dash stucco exactly as they have successfully applied it for over 15 years. Made of Portland Cement and other materials cheaply obtained locally at a cost of 45 cents per sack. Compare this cost with other stuccos and you will find you will save the price of these specifications many times over on one small job. With their methods of mixing and applying this material no contractor can compete with you. Of the hundreds of jobs, the E. W. Holmes Co., Princeton, Ill., have done they have never been called back to do any repair work. These specifications cover pebble dash work from start to finish and are so simply worded that any ordinary workman will be able to do the finest of pebble dash stucco.

An Economical Crusher

We wish to direct the attention of our readers to the possibilities of the "Universal" crushers. The company manufacturing these produces machines suited to any size of plant. The "force feed" principle of these crushers is one feature which will bear deep thought. With one of these machines, a producer of gravel, concrete block manufacturer or contractor can crush stone into any sized gravel desired at the rate of from 5 to 300 tons per day of ten hours.

It goes without saying that the mechanism of "Universal" crushers is simple and strong enough to warrant the best and most economical results. Manganese and crucible steel are used where great strength is required. Space will not allow us to tell you much about the "Universal" line, but the contractor who can foresee the advantages of producing good clean gravel will write the Universal Crusher Company, 230 Bee Ave., Cedar Rapids, Iowa, for its complete catalogues and circulars.

Super Cement—An Improved Portland Cement

A concrete tank was constructed in 1915 at West Tulsa, Okla. It leaked so badly after allowing the usual curing period that it was declared to be unsafe for oil storage. It had remained out of service for a period of six years. When the tank was originally tested with water, after allowing the curing period, the leakage indicated that it was unsafe for oil storage.

The tank was approximately 200 ft. square, and 27 ft. high, having a capacity of 8,000,000 gals. It was located in the Arkansas River valley, and the bottom of the tank was 10 ft. above the river level, in a sandy loam soil. It was originally built in 1915 for the Cosden Oil Co., and was constructed of reinforced portland cement concrete, proportions, 1:2:4, with selected aggregates, walls 15 in. thick at the base and 8 in. at the top. The floor was 6 in. thick and the roof slab 3 in. The interior walls and floor were given a special waterproofing treatment.

In February, 1921, Munn Brothers, who had become owners of the tank, awarded the contract for plastering the inside of the walls ½ in. thick and the floor 1 in. thick, with super cement mortar. The work of plastering was completed in May. Early in September, 1921, the tank was filled with fuel oil and the gauging of the contents twice daily since then has established the fact that the tank is oil tight.

The tank was sold to the present owners, The North American Car Co., which reported December 1, 1921, that the daily gauging of the tank gave no indication of seepage.

The plastering on the interior of the tank, using Super cement, was done by the Monahan Plastering Co., Tulsa, Okla.

It is reported that no hair cracks appeared on the surface.

Super cement is defined by the manufacturers as an improved portland cement, which is packed and shipped in bags of the same size and weight as portland cement and looks the same, and which is mixed in the same manner as portland cement to make mortar or concrete. They say a new and improved process of making cement is used in its manufacture, and during this process specially treated gypsum is added to the cement clinker before it is ground, the virtue of this addition to the cement clinker being in making the particles of Super cement combine freely with the mixing water. For this information Concrete is indebted to Super Cement Co. (America), Ltd., Toronto, Canada.

Diesel Type Engines

The Hadfield-Penfield Steel Company, Bucyrus, Ohio, have issued two catalogs describing and illustrating their Diesel type horizontal and vertical standard fuel oil engines. These engines are built on the two-cycle principle with a cross head which also serves as a pumping piston for furnishing air to clean out and fill the main working cylinder. The horizontal engine is built in three sizes of cylinders and of 50, 75 and 100 horsepower, the last two sizes being built as twin units, giving respectively 150 and 200 horsepower. The vertical engine is built on two-cylinder sizes of 50 and 125 horsepower per cylinder and in from two to six cylinder units.

News of the Cement Mills

Officials of the Lehigh Cement Company have announced that the plant at La Salle, Ill., will be closed down for an indefinite period, or until there is a demand for cement again, but that approximately 75 per cent of the employees will continue at work constructing needed additions to the plant and also making other improvements.

At the present time, it is stated, a full stock of cement is on hand and no more will be manufactured until there is sufficient demand to move the present supply. The Lehigh has been one of the many patriotic concerns to re-employ all the ex-service men who were held to this policy.

The annual meeting of the stockholders of the Northwestern Portland States Cement Co., Mason City, Iowa, was held last week and C. H. McNider was re-elected president. The regulation dividend was paid and officers and directors were elected the same as last year. A. F. Frudden was chosen vice president; F. G. Ray, secretary, and F. H. Keeler, treasurer. Other directors chosen were Hanford MacNider, W. H. L. McCourtie, F. H. Winsmore, M. T. Gunderson, S. L. Wright and W. O. Winston. It was the unanimous sentiment of the directors that this year had been a good one for the cement concern.

Marlboro Cement Co., Edmonton, Alta., has succeeded to the business of the Edmonton Cement Co., Ltd. The officers of the company are: A. Macdonald, president, Winnipeg, Man.; A. W. G. Clark, general manager, Edmonton; F. L. Giroux, secretary-treasurer, Edmonton. The plant of the company is located at Marlboro, Alberta.

Edmund M. Bunce, manager of the Aetna Portland Cement Co., branch at Fenton, Mich., has been chosen to take charge of the Bay City plant to be erected by the same company. The company expects to start building its new unit in the spring.

A new cement plant, financed by local business men and with $150,000 already subscribed by one man for the enterprise, is to be built in the vicinity of San Antonio, according to rumors current in business circles.

A wage reduction of five cents an hour throughout the plant of the Marquette cement company was made last month. It was said that the reduction was general throughout the plant and quarry.

The chief reproach made against rotary cement kilns is the great consumption of fuel. This fact, according to Dr. Valeur, writing in the Revue des Material Construction, is due to an excessive draught of air, whereas when reduced to the strictly necessary amount, the heat of the waste gases and dust from the cement in them decrease, giving an economy in both fuel and cement.

The Valeur process consists in diminishing the velocity of the gases escaping from the kiln on the entire section of the chimney by means of several iron gratings, the width to distance of the openings in them being learned by experience. These gratings must be taken out to be brushed, which can be done in a couple of minutes. The dust retained falls to the bottom of the flues from whence it is carried away by screw conveyors to the feed hopper of the kiln. The proportion of dust is not negligible.

Finally, the energy needed for grinding falls from 115 to 106 kwh. per 100 kg. of clinkers. Then there is the economy in repairs, and lining the kiln which can be executed in 36 instead of 54 days per year.

The Hawkeye Portland Co., Des Moines, Ia., shut down their factory and will reopen again about the middle of March. Not many of the men will be thrown out of work, they say, as the company will be at work on plant improvements until they start work again.

The main improvement will consist of a waste-heat boiler system which will eliminate smoke and furnish heat for the power plant. C. B. Condon, local manager, reports that the cement business at the present time is not so very good and expects it to be nothing extra during the coming spring months.

An electrical device that saves tons of Portland cement dust which had in times past gone into the air only to settle down upon the nearby community has been perfected and is in use in the plant of the Huron Portland Cement Co., at Alpena, Michigan. It has large magnetized plates set up in the path of the cement dust. This dust is ionized by electricified rods and clings to the plates. As the plates become covered, they are automatically cleaned and the cement saved for market.

At first the sparking and arcing about a converter sent out powerful radio waves that interfered with government wireless messages. Readjustments were made so that the waves from the cement device were kept down to 270. As the radio interfered with, used a minimum of 600 meters, the two could not trip each other.

Giant Portland Cement Company declared a 4 per cent dividend on the preferred stock, the first since January, 1920. The preferred is 7 per cent cumulative.

Secretary-Treasurer John L. A. Galster states that the Petoskey Portland Cement Company will double its capacity the coming year. This statement has given pleasure to everyone in this region and has stimulated interest in the building of new homes. There are no houses for rent in Petoskey at this time, newcomers contenting themselves with temporary quarters until their needs may be met.

Discriminatory rates on cement shipments were alleged by the Universal Portland Cement Company against the Atchison, Topeka Railroad Company and others before Examiner Keeler of the Interstate Commerce Commission at a recent Chicago hearing. Cement firms from Cape Girardeau, Hannibal and St. Louis, Mo., and other border towns appeared as intervening petitioners. In their petition the Universal Portland Cement Company declared that, unusual in such cases, the intrastate rates are sharply lower than the interstate rates.

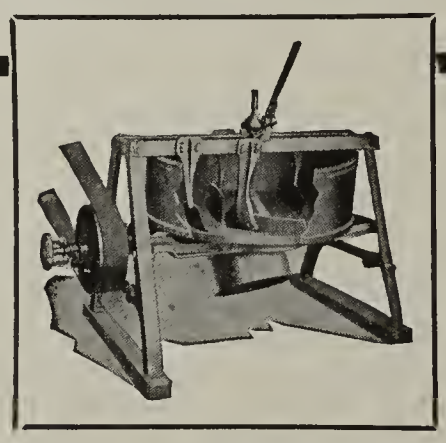
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



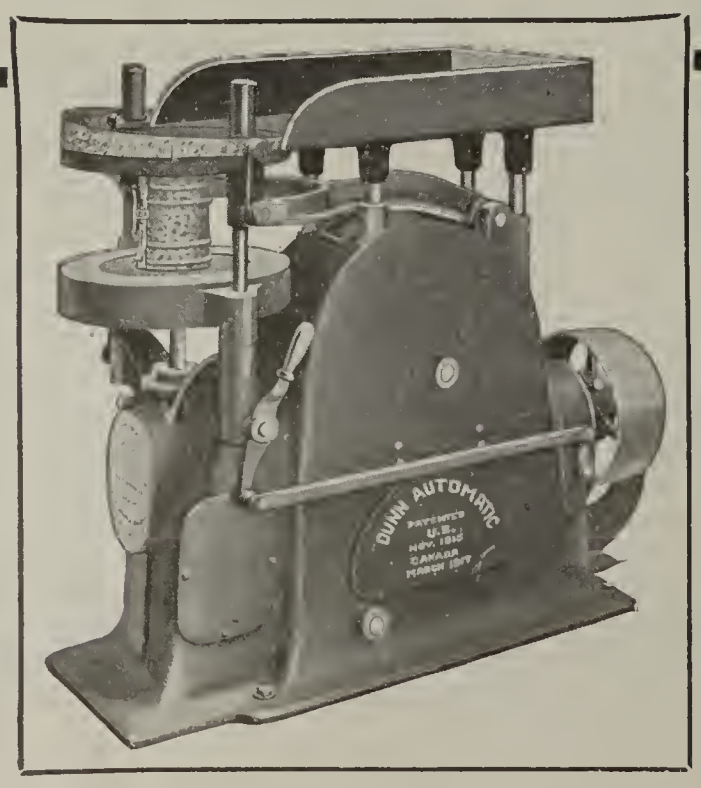
The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

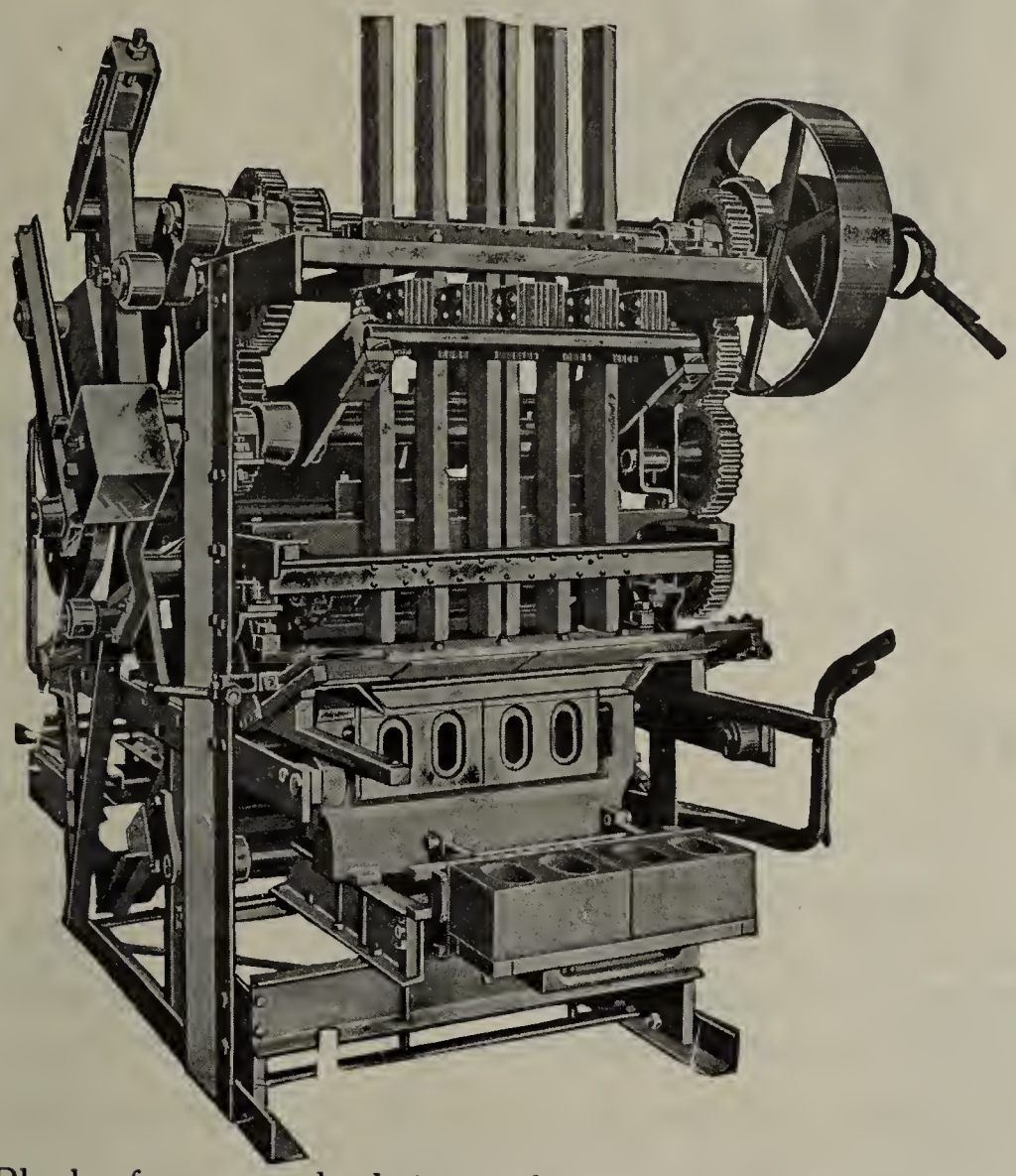
There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

414 W. 24th Street

HOLLAND, MICHIGAN

Besser All Automatic Equipment



Besser Block and Tile Machine
2 in 1

Important Facts

This time tested automatic machine has been in use for years. It will make both block and tile. It will make two different types of tile, all on the same machine. It is not experimental machinery, but tried and proven equipment of known value with years of satisfactory machine service. You can start and make both block and tile with absolute assurance you will not waste time and money in getting started—the **ONLY** COMBINATION BLOCK AND TILE MACHINES.

Products You Can Make

The Combination Machine will make Block of any standard size at the rate of three blocks per minute. It will make tile as follows:

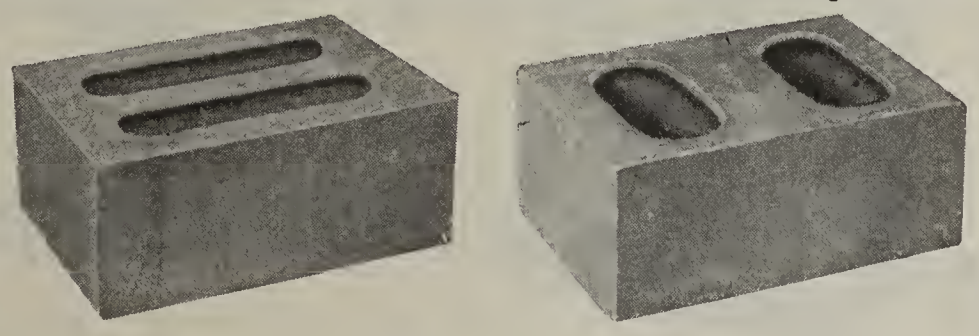
3—5x8x12″ Tile at a time	4800 per day
4—5x6x12″ Tile at a time	7200 per day
6—5x4x12″ Tile at a time	9600 per day

It will also make 5x12x12″ and 5x10x12″ Tile in fractional sizes.

We can furnish machines with 16″ mold to make two 5x8x12″ tile at a time or 24″ mold machine to make three 5x8x12″ tile at a time. These machines are furnished in either hand, semi-automatic or fully automatic types. All Attachments are standardized and interchangeable from hand to automatic power machines, enabling you to increase the capacity by changing attachments from one machine to another without scrapping equipment. These are the advantages of being able to make block and two types of tile on the same machine.

A Besser Combination Block and Tile machine will pay big results. It will enable you to meet the enormous demand for high grade building materials. It gives you the profits from both block and tile and satisfies the demand for both.

Write for full particulars concerning the products and the machines. They are adapted for any purse and any range of production.



The Besser Sales Co.

547 Monadnock Block
Chicago

YOU CAN MAKE BIGGER PROFITS

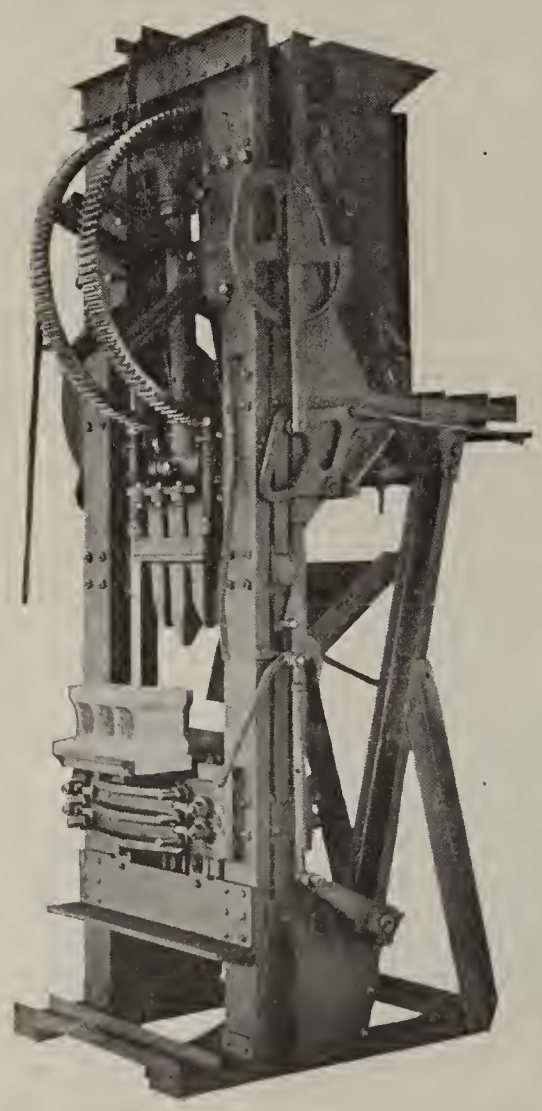
AT LAST! AN AUTOMATIC BLOCK MACHINE

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block by the

Post Economy Punch Block Machine

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.



This machine is the invention of A. L. Post, the inventor of the Kent Continuous Concrete Mixer, which is well known to concrete products manufacturers. It is the invention of a practical block manufacturer, has been thoroughly tested and has convinced men thoroughly versed in concrete block manufacturing that it produces block that are very dense in structure, free from voids, absolutely square and smooth, and which stands the various building code tests, both as to structure and absorption.

We are now placing on the market the following machines, to be known as the

RED LINE PRODUCTS

Automatic Tampers
Block Machines
Block Cars
Lift Trucks
Gravel Screens
Continuous Mixers
Batch Mixers
Elevating Devices
Electric Motors
Gas Engines

KENT MACHINE CO.

KENT, OHIO

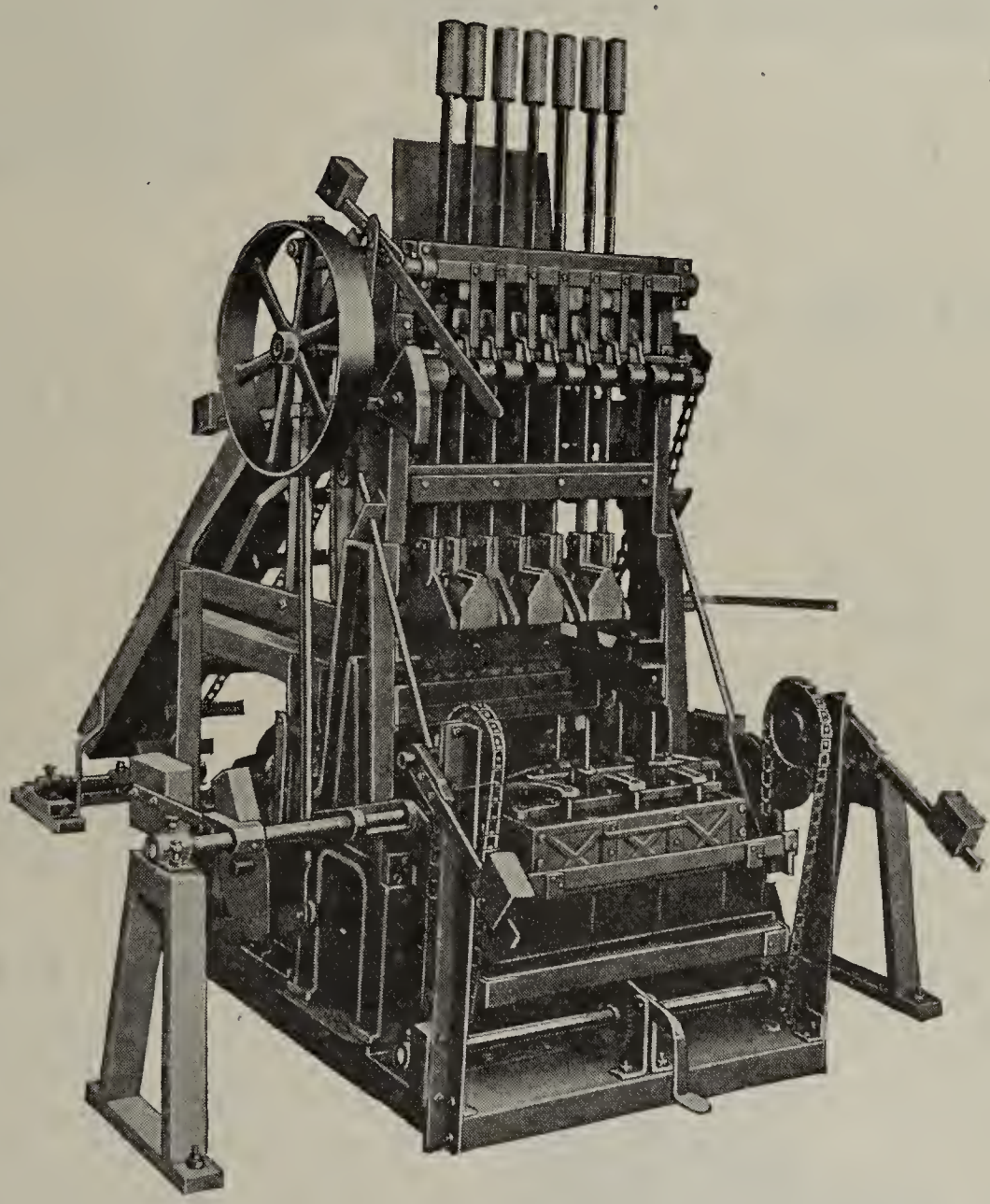
Automatic

through and through—this wonderful new

Ideal

Building Tile Machine

Get this! The machine is rigidly built, all parts in perfect alignment, and is FULLY-AUTOMATIC. Operator merely feeds concrete into the conveyor at the back end, while operator at front end inserts the empty pallets and carries them away filled with tile. The machine is not stopped or delayed while the operators are changing pallets. Just as soon as the tile are discharged onto the wooden pallet, the machine starts on the next set of tile, and the off-bearers carry away the full pallet and put in an empty pallet while the machine is working.



Rate of Speed is Absolutely Fixed

because no time is taken from the operation of the machine for removal of tile, and the insertion of the new pallet. A single cycle of the machine takes 22 seconds and **turns out three tile,** 5x8x12″.

The time-saving, labor-saving, money-making features of this new device commend it to every man interested in the building industry. DROP US A LINE TODAY FOR DETAILS —don't wait till tomorrow.

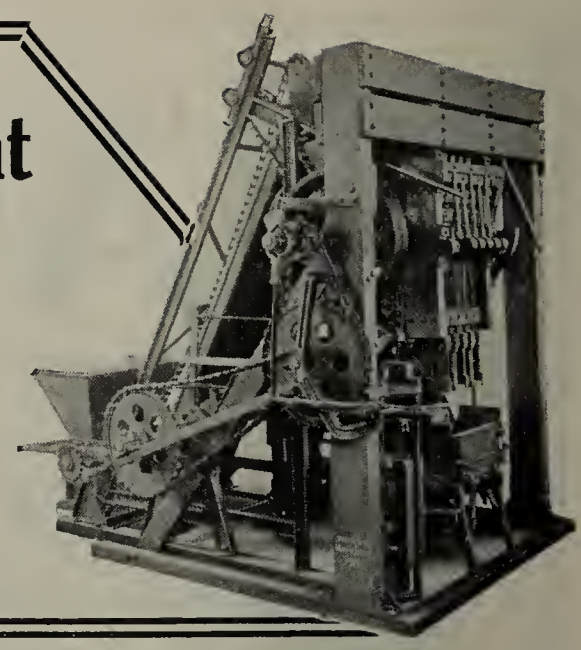
The Ideal Concrete Machinery Co.

1338 Monmouth St. **Cincinnati, Ohio**

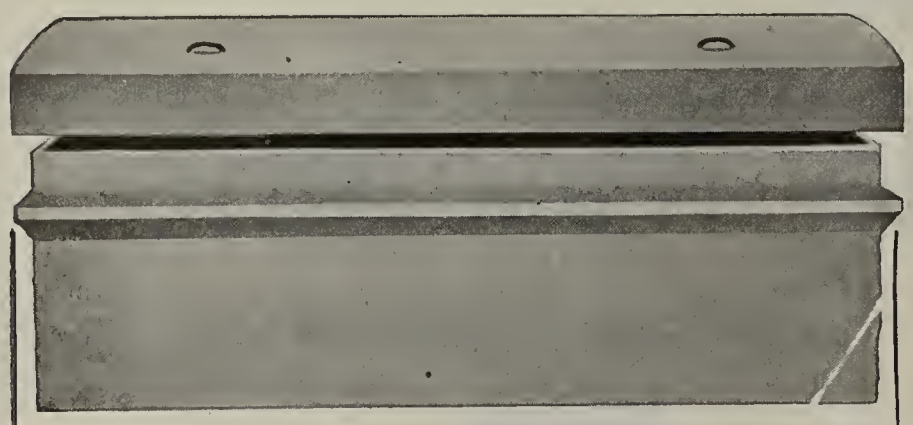
Write Today for Ideal Catalog

Ideal Block-Making Equipment

"Cash in" on the big demand this Spring for building blocks. Our catalog shows everything from a hand machine to the power outfit illustrated herewith, which is capable of making a building block in 12 seconds. Every feature automatic after the operator closes the mold box and pulls a lever.



THE IDEAL CONCRETE MACHINERY CO.
1338 Monmouth Street Cincinnati, Ohio



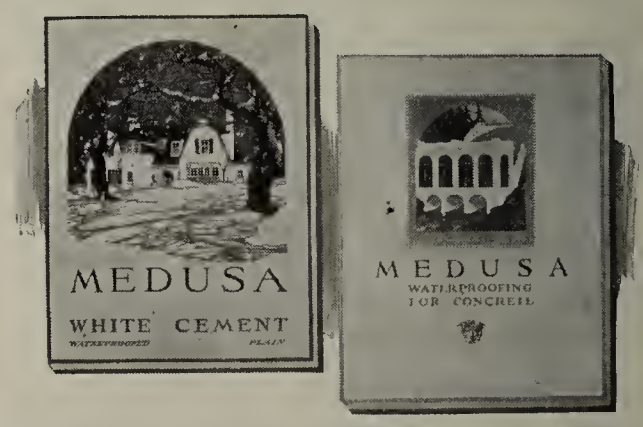
A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.



How to Make The Same Concrete Jobs Pay Better!

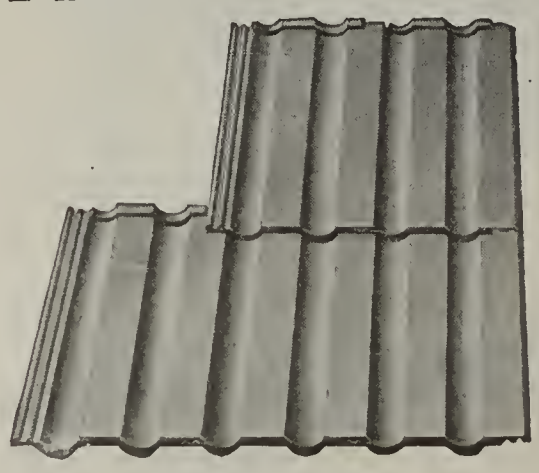
These two "Medusa" books will help you make products that you can sell for more money and that will build you a "quality reputation." They tell, for instance, how to make white stucco that stays white, repels dampness, and doesn't crack. How to make concrete blocks that keep dry even against flood-pressure. How to make unsightly old buildings new again by "overcoating"—and so on.

Every cement-products manufacturer, concrete or plaster contractor, and builder, needs these valuable books. A line on your letterhead will bring them, with name of dealer near you carrying "Medusa" products in stock.

The Sandusky Cement Co.
Dept. E., Cleveland, Ohio

MEDUSA Stainless White Cement

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

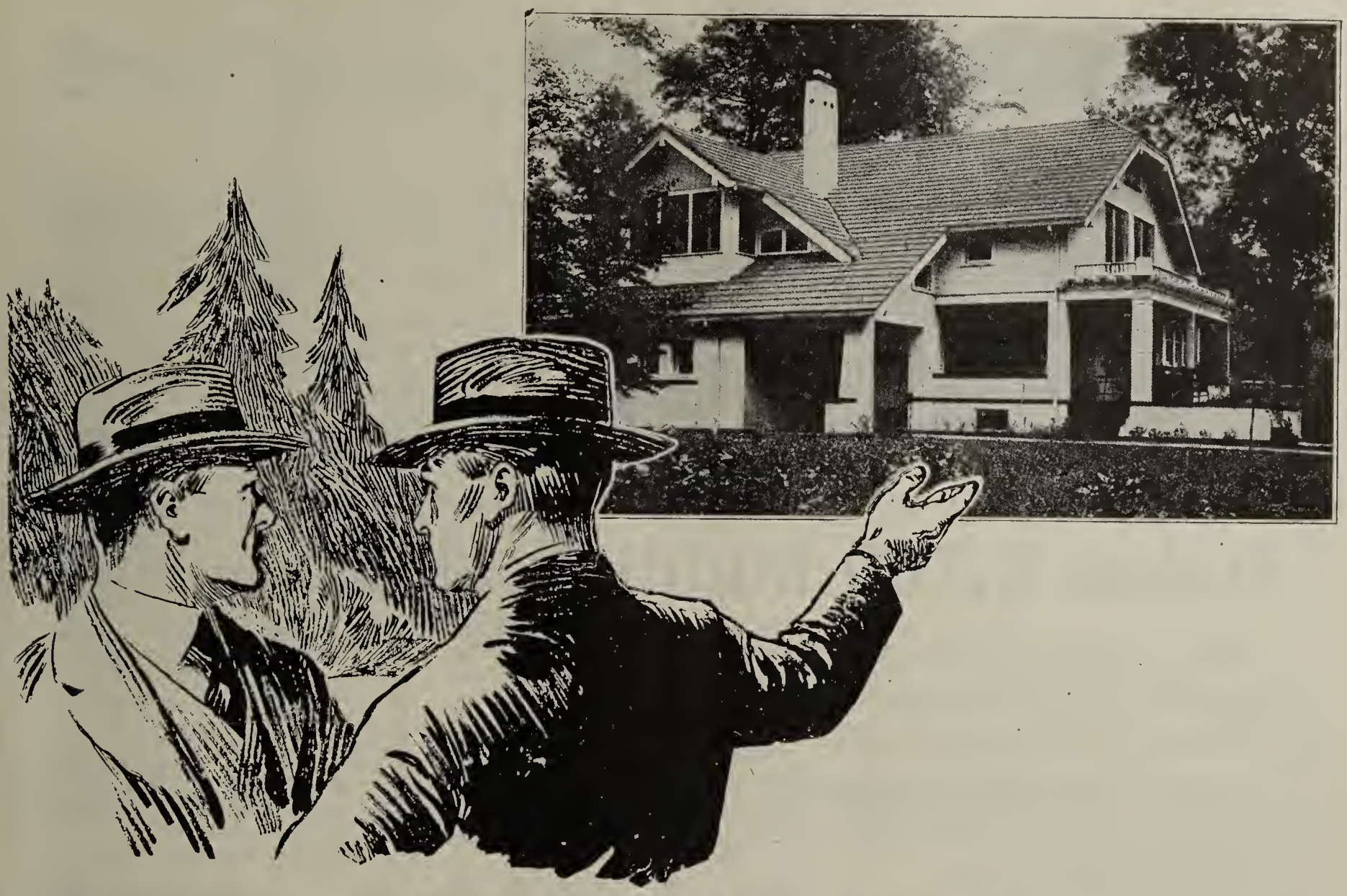
Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name: "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.
3617 E. 23rd Street Kansas City, Mo.

SPANISH TILE



MAKE EVERY ROOFING JOB A BUSINESS GETTER

That means every customer, an enthusiastic booster—every roof you lay, an effective salesmen.

Concrete roofing tile made on an All Automatic Roofing Tile Machine are best advertised by their owners. That's why many builders now use and recommend them exclusively. They know the business such advertising creates.

Concrete roofing tile made on our machines offer a complete roofing service. They are used on the mansion and the cottage—for the barn and the hen house.

All Automatic Concrete Roofing Tile, for sheer architectural beauty, are unsurpassed. They are furnished in two colors—rich warm red and cool sage green.

The All Automatic Hand Machines will produce all the required straight and special pieces for any roof. They require no skilled labor and manufacture 900 straight tile or 300 finishing tile a day. Easy and rapid in operation and the only machines which produce a line of tile where joints can be broken.

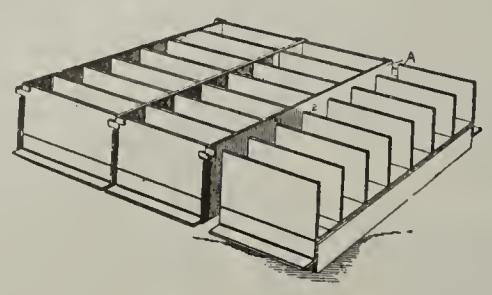
The popularity of roofing tile is constantly growing. Get in on the building boom with a quality popular product for new and re-roofing work.

Complete plants consisting of forms, machines, pallets and moulds, $1,200.00. We help you get started.

ALL AUTOMATIC MACHINE COMPANY

1740 EAST 12TH ST. Suite 590 CLEVELAND, OHIO

MOULDS FOR POURED CONCRETE BRICK AND BLOCKS



Our brick molds are adapted for making both common and faced brick. Pallets are not used as the bricks are discharged from the molds, directly into the pile.

Our DOLLAR block mold is the only mold made, for pourcd block, that can be filled twice every day.

Writc for circulars

MERRILL MOORE
Box 33, Creston, Iowa

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of supplying cement works with

Chemical Apparatus, Chemicals and Reagents

Gilmore's Needles, Cement Moulds, Vicat Apparatus, Schumann's, LeChatelier's and Jackson's Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters

High Grade Goods Only

Satisfaction Guaranteed

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

The Choice of the Well Informed

"THE PRESS THAT MAKES THE MONEY"

We claim—and conservatively—that the Helm brick and block press has embodied in its design and construction more real points of superiority than any other brick or block machine made!

Some of the outstanding features are: Speedy action, interchangeable parts, simple in design and construction, 40 tons pressure on the medium wet concrete, your production is unlimited, etc., etc.

To fully explain these and many other points of superiority—may we send you a catalog?

THE HELM BRICK MACHINE CO.

862 MITCHELL ST. CADILLAC, MICH.

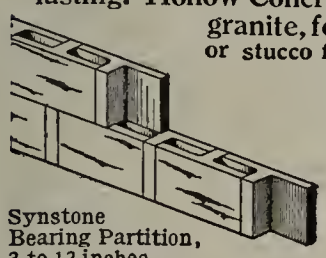
SYNSTONE PRODUCTS

This 8" WALL used exclusively in rebuilding Halifax. Also Minnesota Steel Co's Model City.

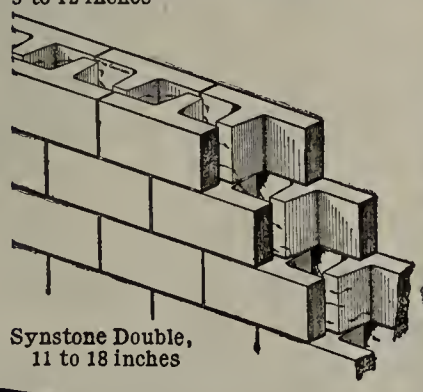
The Last Word in CONCRETE Construction

Costs Less Than Any Other Practical Wall Construction

Wet process, making real Concrete walls, impervious to heat, cold and moisture, fireproof and everlasting. Hollow Concrete Walls, stronger than brick, faced with beautiful natural material—crushed granite, feldspar, marble or sandstone, with all the sparkle and life of natural stone. Brick or stucco facings if desired. A wet, soggy mixture, 1 cement, 2½ sand and small gravel, 4 parts or 1" stone or gravel, producing stone withstanding 3000 lbs. pressure per sq. inch and 1700 degrees heat for one hour without injury. Complete machinery making all walls and all shapes and sizes of blocks required for them, by simply hooking on another core. Every block perfect with true edges. Unskilled labor. one, two or three men, capacity 50 blocks or 100 sq. feet per hour.

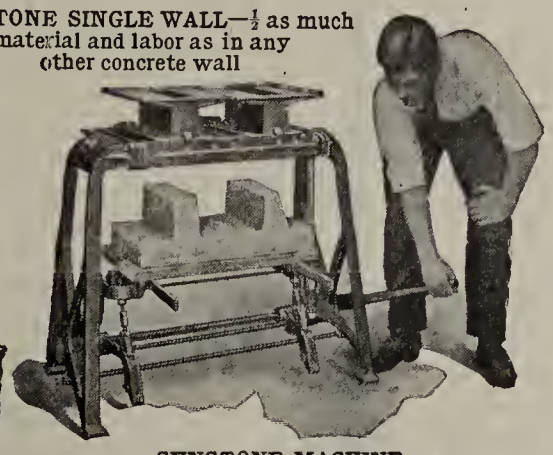


Synstone Bearing Partition, 3 to 12 inches



Synstone Double, 11 to 18 inches

SYNSTONE SINGLE WALL—½ as much material and labor as in any other concrete wall



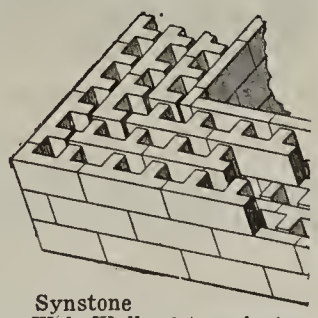
SYNSTONE MACHINE

Send for catalog.

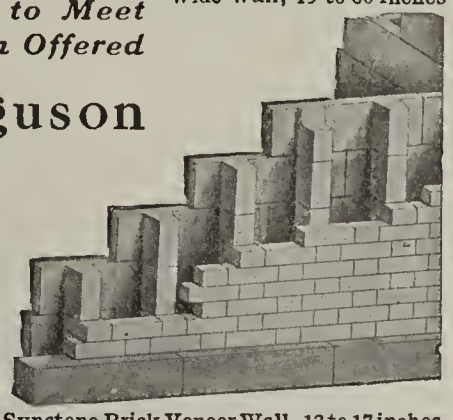
Equip Yourself to Meet any Competition Offered

The Ferguson Synstone Company

803
17th St., Denver,
Colorado, U.S.A.



Synstone Wide Wall, 19 to 60 inches



Synstone Brick Veneer Wall, 13 to 17 inches

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

Sauerman Bros., 1139 Monadnock Bldg., Chicago

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

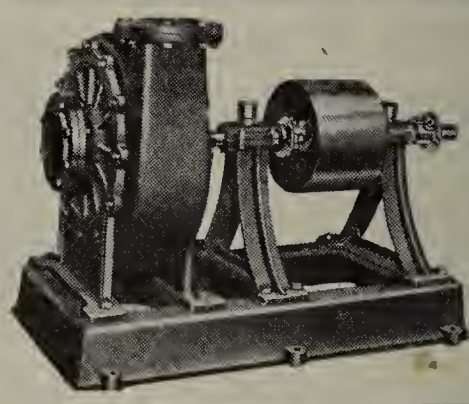
POWER DRAG SCRAPER

The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN
907 Lumber Exchange Bldg. Chicago



THE LIGHTNING SAND, GRAVEL AND DREDGING PUMP

Never Loafs!

The sand company or contractor who has used the Lightning Sand Pump longest, appreciates it most.

It has demonstrated its value and sure satisfaction in thousands of cases throughout the country.

It never loafs on the job, and its life is one long, unbroken streak of production.

Simple in design and construction—drum removable and adjustable to any position; drum sides quickly removable; Ball thrust bearings; front and rear. Shell and runner made of semi steel.

Write today for full information.

Kansas City Hay Press & Tractor Co.
Kansas City, Mo.

Cement and Engineering News

Vol. 34 Chicago, April, 1922 No. 4

Concrete Walls

Concrete as a building material for the walls of ordinary dwelling construction is in its infancy. The elastic properties of this material, the fact that it can be made of any strength required or commensurate with the work it has to do, the fact that it is adapted to any design, no matter how elaborate the fact that it is susceptible to any desired exterior finish and the fact that it may be made as dry as a bone and the finest insulator of heat and cold known today insure the ultimate success of concrete for wall construction.

For the walls of ordinary dwelling houses, concrete as now used is much stronger than necessary, twice as strong as brick construction, and many times as strong as frame. Don't misunderstand me in this statement. I do not advocate for a minute the reduction in strength for concrete in floor slabs, columns, beams, and in fact all structural concrete as it is generally used. On the contrary, I would increase the amount of cement in such concrete and use a greater percentage of steel, thus lightening up on my dead loads. It has always seemed out of proportion to me to put in a floor slab the dead weight of which is, say, one hundred pounds per square foot, to support a live load of fifty pounds per square foot, when by using a richer concrete with a higher unit strength so much of the dead weight of the building could be avoided. Some day a much richer mix of concrete will be used than is at present, but in smaller doses. There will be less volume of a better concrete and a greater ratio of high-tension steel reinforcing.

In the construction of concrete walls for ordinary dwelling houses, the architect should consider, not the concrete of maximum strength and density, but the concrete most appropriate to safely support the loads imposed upon it; a concrete composed of aggregates most suitable of affording the poorest conductor of heat and cold, thereby affording a wall entirely free from moisture, either due to atmospheric condensation or ordinary rainstorms; and last, but by no means least, a wall susceptible of a beautiful exterior and permanent finish, eliminating all ornaments, balconies, etc., that need painting constantly, such as wood or galvanized iron, replacing these materials with permanent cement construction moulded as a monolith with the wall itself.

If these suggestions be followed, and a suitable means of eliminating the expensive form-work be used, concrete walls in dwelling houses will have come into their own and will not only make concrete a serious competitor of brick and stone, but even of ordinary frame construction.

Stucco

"Stucco as a building material offers a wide range of possibilities. It becomes like stone, is weather proof, fire proof, and water proof. It is claimed by those living in stucco houses that 40 per cent has been saved in fuel costs.

"Our method of blending the granite and marble, aside from its indescribable beauty, serves as a reinforcement to the entire surface. The pebbles we use are granite and marble—Nature's own colors; they cannot fade. It puts an end to costly repainting. It eliminates every form of upkeep. The vari-colored marble and granite never grow old, and blend most beautifully with the lawns and wooded surroundings, and it ages most gracefully, gathering strength and beauty with the passing years," writes the E. W. Holmes Pebble Dash Co., Princeton, Ill.

"Pebble-dashed homes attract attention. They are admired by everyone. If you want exclusiveness, they offer you so many refinements.

"If you want to remodel, for the modest cost expended it will effect changes that will more than add to the value. It removes every evidence of the old structure and puts newness in its place.

"We apply pebble-dash on old or new houses, churches, or business buildings. For new houses the siding can be omitted, making the cost about the same. We apply it on wood, lath, asphalt lath, wire lath, hollow tile, stone, concrete or brick. Figured in dollars and cents, no other method of construction will give you equal results.

"Price should be a secondary consideration in stucco work. Many a job has been spoiled by inexperienced workmen. This does not happen with us. All the materials are tested, and our work is done by experienced mechanics that know the proper mixing and method of application. Every job is done by an expert in accordance with prescribed mixtures.

"We carry a big stock of marble and granite, and with our force of skilled workmen we can take care of all the work that is turned over to us.

"We are one of the largest exclusive pebble-dash stucco contractors in the country and we offer, at a moderate cost, to any contractor or builder in the country specifications to make and apply pebble-dash stucco exactly as we have successfully applied it for over 15 years. With our method of mixing and applying this material, no contractor can compete with you. Send for further information and sample."

Wire Rope Problem Settled

"Never again will you need to feel concerned about the grade of wire rope you get if you specify and insist upon Williamsport nor will you need to support elaborate and expensive testing laboratories and engineers to waste any time testing Williamsport wire rope. The Williamsport Telfax patented tape marker protects you more faithfully than any insurance policy.

"We do all that for you and insure you absolutely against any possibility of substitution—willful or otherwise," writes the Williamsport Wire Rope Co., Peoples Gas Building, Chicago, Ill., and Williamsport, Pa.

"Step by step Williamsport is earning the enviable reputation of being the fastest growing wire rope plant in the world because it deserves it. We ignore old time methods and earnestly try to improve not only the manufacture of wire rope and the methods used, but we now make available to you for your benefit the greatest achievement in the accurate marketing of this superior product.

"Millions of dollars have recently been spent on new, most modern plants, machinery and scientific devices until today this mammoth plant stands out as a monument to wire rope industry.

"And now with the absolute protection afforded you with—

—All wire drawn by us from rods made after our exacting specifications

—all wire rope made from rods of the same heat, thus insuring every wire in every strand being of equal strength and wearing texture

—every rod and every wire submitted to competitive tests

—positive assurance by this patented Telfax marking tape, of your getting exactly what you buy,

we believe with these facts you will insist upon Williamsport and the protection it gives to you. May we get an expression from you?"

Anchor Stave Tamper

Anchor Concrete Machinery Co., Rock Rapids, Ia., is distributing a leaflet describing the Anchor stave tamper it manufactures. The Anchor automatic stave tamper is made to operate over any type of stave machine. It is built of solid steel and iron by skilled mechanics and with modern machinery. Each tamping rod, made from polished steel shafting, drops 17 ins., striking seventy-five 700-lb. blows per minute. These tamping rods are raised by heavy annealed steel crank arms keyed and pinned to the driving shaft. Crank arms are equipped with fibre rollers where they come in contact with the lifting guides attached to the tamp rods. The drive pulley, 26 ins., in diameter is equipped with a special shock absorber, consisting of four heavy springs which transmit the power evenly through the crank shaft to the crank arms, thus preventing crystallization of steel parts. In addition to the easement produced by the shock absorber the fact that all working parts are fibre against steel further aids in the prevention of crystallization. The break device throws each tamping rod in and out of operation in exact time. When the tamper is thrown out of operation an eccentric automatically lifts all tamp rods clear of the crank arms so that practically no power is used when stave is being taken from the mold box. All machines are fully guaranteed. Anchor tampers are also made to operate over any type of block, brick or building tile machine.

National Forestry Policy Committee

"Economic conditions throughout the county require that lands unfit for agriculture and suitable only for timber growing should be put to work, and Minnesota has several million acres of such land" Governor J. A. Preus told members of the National Forestry Policy Committee of the Chamber of Commerce of the United States at its hearings in Minneapolis. "Timber growing by private individuals is rendered almost impossible because of taxation," continued Governor Preus. "Either these worthless lands must be gotten into the hands of the public or some method of relief from taxation be devised. This is going to be a difficult problem because there is an increasing disposition to tax natural resources such as iron, coal and timber by means of the so-called Severance Tax."

State Forester W. T. Cox stated that fire protection had proven effective and could be made more so by increased expenditure.

J. M. Hughes, Land Commissioner Northern Pacific Railroad, urged that tax laws be amended so that the burden from that source would be lessened. The average tax paid by the Northern Pacific on its timber lands was 1½ cents per ace ten years ago and last year 16 cents, the total bill paid the Government being $800,000. Mr. Hughes added that there is no indication that taxes will stop increasing. 60% of their timber holdings are at present inaccessible and will not be accessible for thirty years. If the present rate of taxation should continue it would not be practical for the company to hold this timber.

T. B. Walker, the largest individual timber owner in the United States, testified at length and pointed out the weaknesses of our Federal Land Laws as compared with the laws of Canada. He pointed out that it was not the lumbermen but the laws that were responsible for the wastefulness of American methods. Mr. Walker stated that he did not believe trees could be grown except by actual planting. State Forester Cox and others present took issue on this point, and cited cases in Minnesota where good reproduction had been obtained by methods of cutting and forest regulation.

The meeting developed an important question regarding present freight rates, it being pointed out by Mr. Gilkey and others that a large amount of low grade forest products were not marked because in many instances the railroads charged as high rates on these low grade products as on high grade lumber, as much on sawdust and shavings as on sash and doors.

A Novel Paper-Weight

The Austin Machinery Corporation is sending out to prospective customers a very novel paper-weight in the way of a glass reproduction of their "Cube" Mixing Chamber. This, together with a card of instructions and a small muslin bag of white sand, is contained in a paper box. The glass "Cube" contains red sand and a brown bean. The instruction card explains the unusual mixing action that takes place in the Cube shaped chamber as it is rotated, the idea being to show exactly how the concrete is mixed. The brown bean illustrates the folding action as the bean comes right up through the mixture three times with every turn of the cube.

Methods of Crushing Stone in Texas

The extensive road-building program in Texas and the consequent great demand for material have resulted, among other things, in the discovery of a ledge of high-grade limestone, forty feet thick, and in the organization of the Lone Star Stone Company, for its development.

When a single county like Dallas has $8,000,000 available for road construction and requires 17,000 carloads of stone, a good quarry in the hand is worth more than two oil wells in the bush, as it were. So thought Mr. G. D. Anderson of Wichita Falls, who located the ledge of rock, and so thought some of the good people of Wichita Falls, who with oil all around them, joined Mr. Anderson in financing the quarry project.

The company owns 360 acres of this stone in Wise county, near Chico, Texas, on the Rock Island Railroad, and began operations about a year ago, with a thoroughly up-to-date plant. The stone lies very near

View Showing Quarry Face and One of the Sanderson Cyclone Drills

the surface and the plant and track-layout have been so constructed that there is a short haul and a grade of less than one per cent.

The ledge of rock is shot down with 40 per cent dynamite, two tons at a shot. About 16 holes are drilled for each battery, 40 feet deep, which carries them to the bottom of the ledge. The drilling is done with Sanderson Cyclone drills. One shot loosens up about 16,000 cubic yards of stone, so that it can be handled by a 90-ton shovel.

For hauling the company purchased 21 Western 6-yard side-dump cars, which are handled in trains of six cars each by Vulcan locomotives. These are standard gauge cars. The loaded train moves forward from the shovel a few hundred yards to a switch and then is backed a short distance to the plant and through the crusher shed, where a huge gyratory crusher is ready for business. This crusher handles two carloads at a time, the cars being dumped by hand, one on each side of the crusher. It takes about ten minutes to unload a train and each train-load, when crushed, loads a 50-ton railroad car, ready for shipment.

Lone Star Stone Co.'s Quarry. Loading Western 6-Yard Dump Cars

Lone Star Stone Co.'s Crushing Plant, near Chico, Texas

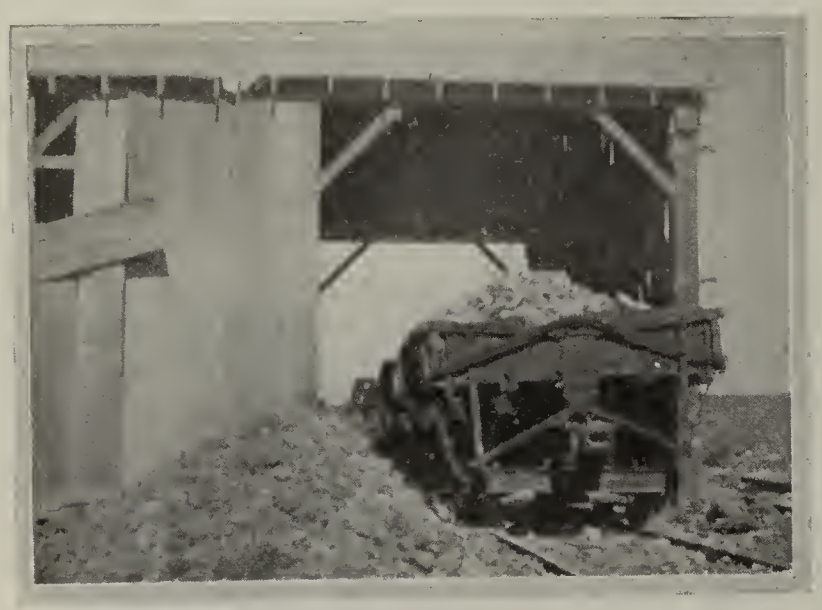
In quarry work and gravel mining, as in great ore stripping and mining operations, although in a less degree, the tendency is toward larger and larger loading units. Recognizing this, the six-yard dump car is being quite generally adopted in the newer installations. The Western six-yard car is a standard gauge car with a single truck. It is the smallest of the standard gauge sizes and its use permits future increases in size to be made at a minimum cost.

From the No. 12 main crusher the stone is carried up to four No. 5 crushers for reduction to the proper

size. From there the material is carried to the top of the plant, where it is screened and separated into five sizes for shipment.

Owing to the car shortage the crushed stone has been shipped in any kind of a car available, box-cars as well as open-top. The latter are loaded from the bins by gravity. For loading box-cars a box-car unloader has been installed. The plant has Allis-Chalmers equipment throughout.

To get a water supply a substantial dam was built



Dumping Western 6-Yard Cars at the Crusher. The Crusher Handles Two Cars at a Time

across a creek and the adjacent bottoms. In Texas water must be stored up during the wet season for use when it is dry. A small lake of clear water has formed back of the dam, sufficient for the requirements of the boilers, although 15,000 gallons per day are used.

Among other contracts, 15 carloads of this crushed stone per day are shipped to Dallas county; 10 carloads to Wichita county, and a number of carloads to

Dam and Reservoir, for Water Supply

Terrant county. Forty-five men are employed at this plant, forming a little settlement of their own. J. E. Taylor is the superintendent in charge.

The officers of the Lone Star Company are J. A. Kemp, president; O. C. Smith, secretary; and G. D. Anderson, treasurer and general manager. All live at Wichita Falls, where the main office was established. Recently an office was opened in Fort Worth, 416 Dan Waggoner Building.

Manganese Steel Castings

Arthur Whitcraft, M. E., has assumed charge of the manganese steel sales department of the Hadfield-Penfield Steel Co., Bucyrus, Ohio. Mr. Whitcraft was for 12 years with the American Manganese Steel Co. as a sales engineer engaged in the design application and sale of manganese steel castings. During the war he was a captain in the Ordnance Department.

A New Consulting Organization

A new engineering company has been organized in the cement, lime and allied industries under the name of Waller Crow, Inc., and has started in business at 327 South La Salle street, Chicago, where it is prepared to handle practically all problems in connection with the production of non-metallic minerals, paying particular attention to the rock products industries, such as gravel, sand, cement, lime, gypsum, potash, fertilizer rocks, etc.

Its field will be so broad, indeed, that it may be adequately described only in a summary such as the following:

Utilization of by-products now wasted and discovery and utilization of rare earths and minerals and their economical treatment on a commercial basis.

Direction of large engineering operations, acting as consultants to engineers and their clients as well as arbitrators on special equipment or processes whose actual value is unproven in commercial operation.

Design and specification of proper machinery and equipment for the economical handling of bulk material of whatever nature.

Solution of combustion problems as they relate to calcination and sintering.

Research in fluxes, special heats and commercial reactions, serving as consultants.

Solution of all chemical engineering and mechanical problems on a commonsense basis, using theory only as a means to a practical end.

The organization is headed by the man whose name it bears—Waller Crow—an engineer of wide and varied acquaintance. Mr. Crow is a practical engineer with college training and his activities have covered banking, lumbering, accounting, mining, ceramics, lime, cement and other industries, included in which is actual operating experience in mining, quarrying, combustion, ceramics, automatic machinery, material-handling and transportation. Mr. Crow has personally made many notable geological reports, having carried on geological work and prospecting in the Blue Ridge mountains, the Piedmons, Ozarks, Cascades, Rockies and costal plains.

Work will be undertaken for clients on a flat-fee basis or on a basis of cost, as desired. A regular staff of corresponding consultants will be maintained, any of whom will be available personally at any time, thus insuring the clientel of a far-reaching scientific contingency. The principles in this organization are well known to the publishers of CEMENT AND ENGINEERING NEWS, as well as allied interests, and can be unreservedly recommended.

Oil Engine, Chicago Office

The Anderson Foundry & Machine Company of Anderson, Indiana, manufacturers of the well known Anderson Oil Engine, have opened a branch house at 2825 West Harrison street, Chicago, Illinois, with Mr. R. E. Gray as manager. The Chicago office have on display in their salesroom a 30 H.P. Type K. oil engine, and will look after the business of selling Anderson Oil Engines in the territory tributary to Chicago. They will be pleased to receive any inquiries from parties interested.

Importance of Construction Industry

The construction industry is ordinarily referred to as second only to agriculture in the magnitude of its operations. Food, fuel and shelter are the three primary needs of man's life. Construction reached in amount of contracts awarded in 1921 over $2,000,000,000 as shown by the F. W. Dodge Co. reports, the recognized authority.

The needs of construction for the year 1922 are not limited to those incident to a year's normal needs. During the war building and other construction, except for war purposes, was almost entirely suspended and this shortage has not yet been supplied, nor is it likely to be for a number of years, especially in regard to dwellings.

Need of Homes

The shortage is particularly large in regard to homes. This is reflected in the high rents prevalent almost everywhere for either living apartments or dwelling houses. The President's Conference on Unemployment in its report of September 29, 1921, p. 21, says:

"We are short more than a million homes; all kinds of building and construction are far behind national necessity."

A survey of needed construction carried on recently by "Building Age" reports (issue for September, 1921) that the construction necessary to relieve the present shortage of buildings amounts to $7,812,985,432, and that $5,106,089,500 of this shortage is in houses and $709,174,000 is in apartments. The present prospect of completing the needed construction is deeply bound up with the question of reduction in cost. Every dollar's reduction in cost reduces the interest charge and makes prudent investors readier to build. It also permits lower rents, a factor of importance in assuring occupation of buildings.

Reduction in Cost, Except Freight

Costs of material and labor in the construction industry have fallen far below the peak Freight as a constituent of material cost has not shared this reduction, save in a very few moderate instances. The Division of Building and Housing of the Department of Commerce, using figures of the Bureau of Labor Statistics, shows that, as compared with 100 as the 1913 average, the index of building materials reached 310 at the peak in 1920, but that in December, 1921, it was reduced to 163.2.

There is no similar official generalization of statistics of building labor. It would be hard to make this, since wages vary greatly in different localities. It is complicated greatly by the decrease in efficiency of labor in time of high wages, both occurring simultaneously from the same cause—the demand for labor exceeding the supply. In a general way, it may be assumed that the labor peak and decline coincide generally with materials. The present labor rate is probably not far from the material rate of 163.2, compared with the same datum of 100 in 1913.

Contrasted with these decreases from the peak is the continuance of freight rates as the peak or, in a few exceptions, near it.

Industry Disturbed by Rate Changes

It was a necessary war policy to restrict construction to the lowest levels, except as necessary for war purposes and to reserve the railroads for the use of necessary war material. Accordingly, the war increases of freight rates were purposely arranged to discourage the transportation of heavy construction materials. The horizontal freight increases were dictated by the apparent necessity of the times. The uniform rate of increase was bound to affect heavy low-priced construction materials far more than materials of higher value upon which the percentage of freight to value was very small. The balanced percentages of freight to value of material were overturned. It is doubtless no wadmitted that a general horizontal increase is an unscientific method of rate adjustment, only fit for temporary use in emergency. The heavier construction materials, considered as a group, are probably the most important money-earning freight carried by the railroads, after coal. The effect of the treatment of these commodities in regard to freight rates, while affecting adversely both the producers and the user by increasing cost, could hardly fail to make widespread disturbance of commercial conditions which would operate unfavorably to railroad receipts from this important source.

Relation of Freight to Construction Costs

It has not been possible to obtain any exact figures showing how much the element of freight enters into construction. This of necessity greatly varies with the nature of the structure and the proximity of the work to the heaviest materials used. Its importance is recognized and defined in the report adopted by the President's Conference on Unemployment on October 12, 1921, p. 115, Committee on Construction Industries, as follows:

"Readjustments of and reductions in freight rates on construction materials are essential to a sustained revival of building activity. Increases in rates on construction materials imposed during the war left the construction industry under a relatively heavier handicap of increased transportation costs than had been imposed on most other commodities.

"To this war-time increase in freight rates has since been added an increase of 25 to 40 per cent, thus perpetuating and even magnifying the effect of the war-time policy of restricting general construction activity.

"The construction industry can not function effectively under a freight rate fabric artificially distorted by the continuation of restrictive war measures. A great economic waste would be incurred if, because of failure to reduce and readjust freight rates, existing plants for the production of construction materials had to be abandoned and a new alignment of producing facilities established in accordance with the present rates a fabric originally designed, in the public interest, to discourage the very thing which, in the public interest, the Government now desires to encourage; that is, the normal operation of industry. The financial burden of such a readjustment of plants would have to rest ultimately upon the public and its necessary effect would be to curtail existing competition and to limit the radius of distribution of many of the construction materials."

The National Federation of Construction Industries and National Association of Builders Exchanges adopt the general line of arguments presented to the Interstate Commerce Commission by the producers of particular construction materials—steel, lumber, cement, sand and gravel, brick and plaster, as well as of coal—and suggest the adoption of the following principles:

1. Wherever it appears that through the influence of rate increases traffic in heavy construction materials has been diverted to trunk or water transporta-

tion, the rates should be reduced so that the railroads may have a chance to restore this source of income and the producers and consumers have the benefit of competition between railroads and other methods of transportation.

2. That such rates should be adopted as will not tend to confine producers to sales in a limited local market, but will leave open to them a wider geographic range of market, thus offering to consumers a larger choice and a freer competition and to the railroads an opportunity to receive freight for longer haul.

3. That in adjusting rates those on heavy low-priced construction materials should be recognized as entitled to bear a proportionately less increase over pre-war rates than those on less bulky and more costly commodities.

4. That the importance of home building, resulting in reduction of the unduly large rents now paid by workingmen, should be considered as an element of importance upon the future prosperity of the entire community, in which the railroads have an important share.

In support of the last proposition, these two associations cite the opinion of the President, expressed in his address to Congress on December 6, 1921 (Congressional Record, 67th Cong., 2d Sess., Vol. 62, p. 97):

"Home making is one of the greater benefits which government can bestow. * * * It is easily possible to make available permanent homes which will provide, in turn, for prosperous American families, without injurious competition with established activities, or imposition on wealth already acquired."

A Fatal Quarry Accident From Falling Rock

By Oliver Bowles*

In a previous report of the Bureau of Mines (Serial No. 2086) references was made to a fatal accident from falling rock in a quarry in Utah, and ways of avoiding such accidents were pointed out. A fatal accident similar to it in some respects recently occurred in a limestone quarry in Maryland. All operators of stone quarries are desirous of reducing accidents to a minimum, and almost without exception they welcome any suggestions having in view the establishment of safer quarry practice. It is believed, therefore, that a brief outline of the circumstances surrounding this later accident may be of practical advantage to quarrymen, as it may serve as a guide to them in so conducting operations that such unfortunate occurrences may be reduced in number.

The quarry where the accident occurred is in form a circular pit 500 to 600 feet across and 80 to 100 feet deep. The rock is a dense limestone with the beds dipping at an agle of 35 to 45 degrees from the horizontal. Numerous erosion cavities in the form of pockets or narrow spaces following joint planes are filled with red sand and clay. They are confined largely to the upper 20 or 30 feet of the deposit. Open bedding planes are 4 to 10 feet apart toward the surface, and are spaced at wider intervals toward the base of the quarry. The open bedding planes present smooth uniform rock surfaces, that dip steeply into the pit at the northeast side of the quarry opening. These smooth surfaces constitute a source of danger, as they may permit loose material to slide into the pit.

In this particular instance a blast had been discharged, throwing down a mass of rock for steam-shovel loading. Three men were employed thereafter for a period of about two days in cleaning down all loose material that might be dangerous to workmen during the loading process. A mass of red sand and clay in which several large bowlders were embedded was left on one of these slanting surfaces, for the material seemed to be sufficiently secure to be quite safe. The lower edge of the slanting surface was about 25 feet above the quarry floor. The quarry conditions are illustrated in fig. 1, where (a) represents the quarry floor, (b) the vertical quarry wall, (c) the slanting joint plane surface, and (d) the rock and earth resting on the surface.

After the steam shovel had been in operation several days loading rock in this part of the quarry, a heavy shower of rain fell, and it would appear that the running water washed away some of the supporting soil from the base of the larger rock mass. Loading was resumed when the shower was over, and shortly thereafter the bowlder, estimated to weigh about 4 tons, rolled over the edge without any warning. One man was killed, and several others, though unhurt, had very narrow escapes.

Steeply inclined open bedding planes are not of uncommon occurrence, and wherever present, they

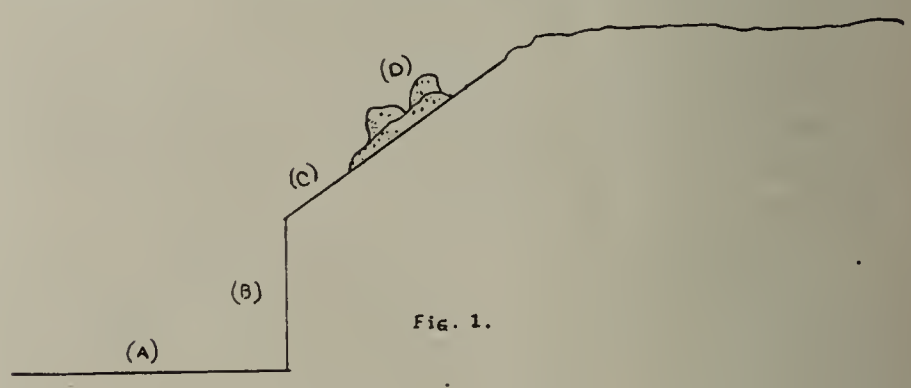


Fig. 1.

demand careful quarry practice. They are present in one slate region in northern Maryland, and while no serious accidents are recorded, rock slides of great magnitude have resulted. While there is the possibility of large masses of rock sliding down on such smooth faces, the greatest danger is from loose material remaining on or above the inclined surfaces. The accident described above cannot be attributed to negligence nor carlessness, but rather to mistaken judgment, for as already noted it is customary at this quarry to clean the walls after firing large blasts. This accident, however, emphasizes the necessity for extreme care in cleaning down all loose material from steep faces, and it is hoped that all quarrymen will profit by having attention directed to this source of danger. Statistics show that falls or slides of rock or overburden are one of the principal causes of accidents in quarries (Quarry accidents in U. S. in 1920, Tech. Paper 295, Bureau of Mines). Operations at the quarry face should therefore receive the most careful supervision; every effort should be made to keep the walls in safe condition; and no careless or improper quarry practices should be permitted.—Reports of Investigations, U. S. Bureau of Mines.

*Mineral technologist, Bureau of Mines.

Concrete Stock-Watering Tanks

Practical Details for Construction of These Necessary Modern Adjuncts of the Successful Farm.

It has now become a worn-out commonplace to tell the farmer that the much-to-be-desired ends of increased economy and efficiency in farm management, lightened labor, lowered overhead charges of insurance and maintenance, and improved quality of all kinds of farm products are best served by invariably using concrete whenever any old wooden structure of any kind has to be replaced or a new structure added to the farm equipment. The practical working-out of construction details, however, based on the carefully observed and recorded results of wide experience, is a service that can never lose its interest or its value; and we give below the following data on the construction of concrete tanks for water supply to farm stock.

Rectangular Tanks

Stock tanks may be either rectangular or circular in plan. Most tanks today are built rectangular, as forms for this shape are easiest to make; but circular forms which are more readily available for repeated use, are frequently employed, especially by contractors who make a regular business of tank construction. Wooden forms can readily be built by ordinary home talent supplemented with a little mechanical ingenuity; but there are also on the market adjustable steel forms for both the rectangular and the round type of tank, and the manufacturers always send along with these forms full instructions for setting them up.

Materials for Rectangular Tanks of Various Dimensions

Capacity in bbls.	Dimensions for Figure							Materials		
	A	B	C	D	E	F	K	Sacks Cement	Cu. ft. Sand	Cu. ft. Gravel
56	16′	8′	2′11″	2′2″	6″	4″	9″	39	75	98
48	16′	7′	“	“	6″	4″	9″	35	68	89
40	16′	6′	“	“	6″	4″	9″	31	60	80
42	14′	7′	“	“	6″	4″	9″	31	60	80
34½	14′	6′	“	“	6″	4″	9″	28	54	71
28	14′	5′	“	“	6″	4″	9″	24	47	62
31	12′	6′	2′10″	“	5″	3″	8″	21	40	52
35	12′	5′	“	“	5″	3″	8″	18	35	46
19½	12′	4′	“	“	5″	3″	8″	15	30	39
21	10′	5′	“	“	5″	3″	8″	15	30	39
16	10′	4′	“	“	5″	3″	8″	13	26	33
11	10′	3′	“	“	5″	3″	8″	11	21	27
13½	8′	4′	2′9″	“	4″	2″	7″	9	17	22
9½	8′	3′	“	“	4″	2″	7″	7	14	18
7	6′	3′	“	“	4″	2″	7″	6	11	14
5½	6′	2½′	“	“	4″	2″	7″	5	10	12

In every case, the concrete tank should be either placed on or joined to a surrounding concrete floor, as this prevents the formation of a mud puddle around the tank, renders it at all times easily accessible, and tends to keep it sanitary.

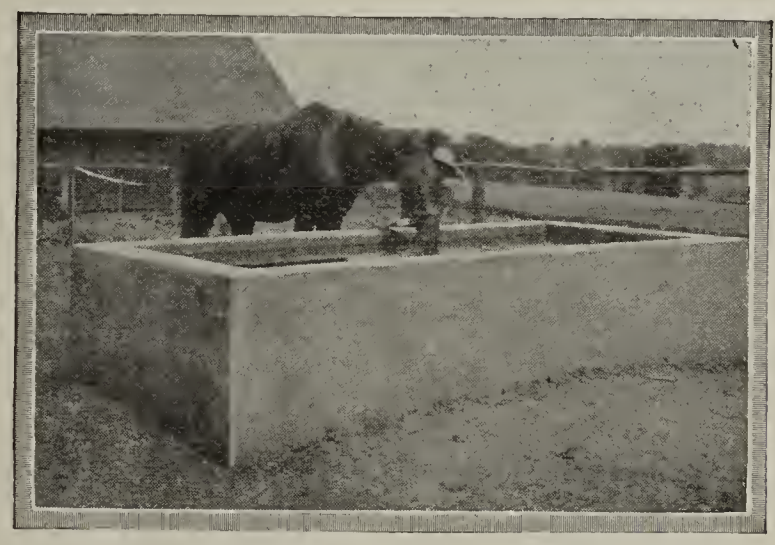
The accompanying table shows the capacity and necessary quantities of concreting materials for construction of rectangular tanks of this type, of various dimensions.

Construction. If the floor is not in place, proceed as follows: The tank must have a foundation of concrete. Make it a plain slab similar to a floor, 5 in. thick, and preferably laid on a well-compacted subbase of gravel or cinders 8 in. deep. Build the form for the foundation around the space to be occupied by the tank, the dimensions being 1 in. greater on each side than corresponding dimensions across the outside of the tank. Thus the completed tank will rest entirely upon this foundation and not upon the floor, which will be built later around the tank. This foundation must harden before starting the tank, and the forms must be removed.

Forms. The forms required are simple. They are constructed of 2-in. timber with 2x4-in. braces and stiffeners. One-in. lumber can be used, provided the number of braces and stiffeners is doubled. The outer form is made the same height as the tank, and is built in four separate sections, which can be nailed together at the corners when needed. The inner form is made equal in height to the depth of the tank, and is set in an inclined position so as to give a batter on the inside of the tank wall. The inside form with braces should be nailed together complete, so that it can be lifted into position after the floor of the tank has been placed.

Mixture. When the form for the tank foundation is ready, mix the concrete in the proportion of 1:2:3, using enough water to give it a “quaky” consistency. Fill in the form about 3 in. deep, and place on it a layer of 1-in. mesh poultry netting, covering the whole area. Then put in the rest of the concrete, and tamp it thoroughly, bringing it up to the proposed level.

Construction. Then assemble the four sections of the outer tank form, and place them on the tank foundation. Fill in with concrete until the thickness of the tank floor is equal to *K*, as given in the table. Tamp the concrete thoroughly, and add a little 1:2 cement mortar around the edge of the tank floor, for a width of 2 or 3 in. greater than the distance between the inner and outer forms. This mortar insures a water-tight connection between the tank floors and walls. Trowel the tank floor smooth.



Rectangular Watering Tank on an Illinois Farm

Then place the inside form in position, supporting it from the 2 x 4 cross-braces, which are lightly nailed across the outside form so as to keep a uniform distance between the two forms at all points. If the inner form touches the floor at any point, remove the mortar top so as to give a clearance of about ¼-in. all around. A 1:2 cement mortar should then be placed between the forms, and worked until it flushes through and is even with the inner face of the inside form. If this layer of mortar is at least 1 in. thick, it will insure a water-tight joint.

Reinforcing. A ¼-in. round or square reinforcing rod should now be embedded in the mortar, 2 in. from the outer form and running all the way around the tank. Lap the reinforcing, if more than one piece is necessary, for a distance equal to 64 times the diameter. For a ¼-in. rod, this would be 16 in. Then place 8 in. of concrete in the form, and place another rod as before. Another 8 in. will bring the concrete within an inch of the top of the forms. Then another reinforcing rod and an inch layer of cement mortar spread over the top, completes the

tank. It is well to make the edges of the wall round by running an edger along the inner and outer forms after the concrete has partially hardened, requiring that the cross-braces supporting the inside form be removed. The form should be left in place until the tank has hardened thoroughly.

Floor Surrounding Tank. The floor around the tank is the next step. It should be 5 in thick and extend 6 ft. out from the tank on all sides; and should slope 1 in. from the tank floor, to provide proper drainage. This floor should be divided up into separate slabs not over 6 ft. square, starting the lines marking the slabs at each corner. Divide the slab along the sides of the tank into convenient equal widths of not more than 6 ft.

Circular Tanks.

Because of its shape, a circular tank will resist freezing better than a rectangular tank. The circular form of tank gives a greater capacity for same amount of material, yet the lumber forms are difficult to construct and therefore somewhat expensive. If several farmers will buy a form to use pointly in building several tanks, it may be wise to use a circular form; but one farmer alone will find it best to use the rectangular shape.

The sub-base and floor foundation for a circular tank should be built the same as for a rectangular tank, and is generally more convenient to make the foundation on which the tank rests rectangular than circular.

Base. Build a square slab foundation 2 in. greater in diameter than the proposed tank. Place 2 in. of concrete in the form; tamp it thoroughly; place a layer of 1-in. poultry netting over the whole surface; and fill with concrete up to the proposed level of the outer floor. The concrete should be tamped, and troweled smooth at least on the corners which the tank will not cover. The form should then be placed on the foundation slab, after it has had a sufficient time for hardening, and the succeeding steps are identical with those for a rectangular tank.

The floor surrounding the tank may be round if the entire barnyard is not to be floored, or rectangular if it is a part of a larger floor system.

Cardinal Points of Stucco

In view of the interest now being taken in stucco designel structures we deem it advisable to elaborate upon the cardinal points of good stucco design to include less evident, but nevertheless important details:

1. Stucco should not be run down to the ground without a solid impervious base course.

2. The proper overhang and drip should be provided for all window sills and other horizontal woodwork, and some stop should be provided at the ends to avoid the concentration of water over end of the sill.

3. The design should be chosen permitting a generous overhang of eaves and cornices.

4. There should be no horizontal surfaces of stucco on which water can collect. Liberal and intelligent use of flashings should be made wherever water might get behind stucco—such as roof and wall intersections, underjoints of masonry trim, etc.

5. Some impervious chimney cap should be provided avoiding unprotected stucco at top of chimney. Chimneys should be surrounded by metal lath before stuccoing. Sheating should be eliminated and metal lath back-plastered according to the findings of the U. S. Bureau of Standards.

Signed: Associated Metal Lath Manufacturers.

Gravel Plant at Oxford, Mich.

The Fuller-Becker Sand & Gravel Company, whose plant is at Oxford, Mich., and who have general offices in Detroit, is credited with being one of the best and most modern plants in Michigan.

The plant is operated throughout by electricity, with the exception of three steam hoists, and is equipped with flood lights for night operation.

The plant was designed and constructed by Raymond W. Dull, now connected with the Link-Belt organization.

Material is obtained with three dragline excavators, and fed directly onto conveyor belts, which elevate it to the screening and washing house. Here it is washed and graded into respective bins.

The oversize material is fed by gravity from the screens to two Universal crushers, and then conveyed to loading bins.

A 6-inch American Well works centrifugal pump supplies water to the washing plant at present, but the company is considering installing a larger pump.

New Quigley Pulverized Fuel Bulletin

A new bulletin on the Quigley Fuel Systems, comprising methods of preparing, transporting, and burning of pulverized fuels has just been published by the Hardinge Company, 120 Broadway, New York.

This bulletin is known as No. 12 and treats the subject of pulverized fuels in a manner never before attempted. One of its distinguishing features is the fact that emphasis is laid upon the methods employed to properly prepare and burn the powdered coal, rather than occupying most of the space discussing the pulverizer.

This bulletin comes at a very opportune moment, for the burning of pulverized fuel has reached the stage in its development where its success is assured. It is now being specified by the largest power and heat engineers in the country as a solution to many problems involving the generation of heat.

Aside from complete plant layouts, what they term as a "Unit Milling Plant" is described. This layout is radically different from anything ever before developed. The System comprises a method of pulverizing and transporting the coal to one or more furnaces in the same locality, at the same time securing positive regulation and continuous operation over extended periods. The cost of this unit is but a fraction of that of the larger Systems where the coal must be transported several hundred feet to a number of furnaces.

From the partial list of users shown in the back of the book, it is evident that the facts as presented in this catalog are backed by a considerable amount of experience, for not only does this list include companies in many classes of industries, but the range of capacity for the complete pulverized fuel plants is extreme, the largest being that of Ougree-Marihaye, Belgium, with a capacity of 600 tons of pulverized fuel per day, which we understand is being used for burning under boilers, forge furnaces, heating furnaces, reverberatory furnaces, and continuous furnaces.

This catalog will undoubtedly be very useful to the engineer designing power plants or furnaces requiring considerable quantities of heat, as facts and figures are given which will aid him in his work. At the same time, it is written in a way that will interest the non-technical person who is seeking a general knowledge of this most interesting and talked-of subject.

New Laboratory Abrasion Test for Concrete

With Spherical Test Pieces the Standard Brick Rattler Gives Definite Results in 900 Revolutions, by C. H. Scholer, Engineer of Tests, Kansas State Agricultural College, Manhattan, Kan.

For about two years the engineering experiment station of the Kansas State Agricultural College, in conjunction with the Kansas Highway Commission, has been studying the possibilities of a laboratory abraasion test, with standard apparatus, which would give definite results in comparing concrete mixtures for pavements. The nature of this study, which is now considered successful, is described in the following article.—EDITOR.

A new abrasion test for concrete is being developed by the Engineering Experiment Station of the Kansas State Agricultural College. The test consists of casting 9-in. spheres of the concrete to be tested and after proper aging and curing, submitting them to abrasion in a standard brick rattler using a standard abrasive charge. It has been found that the full hour's run of 1,800 revolutions is not necessary, 900 revolutions giving sufficient loss on even the toughest specimens to indicate the relative resistance to abrasion, offered by the material.

Spherical specimens were adopted after a trial of rectangular and cylindrical specimens because of the peculiar advantages offered by the spherical surface.

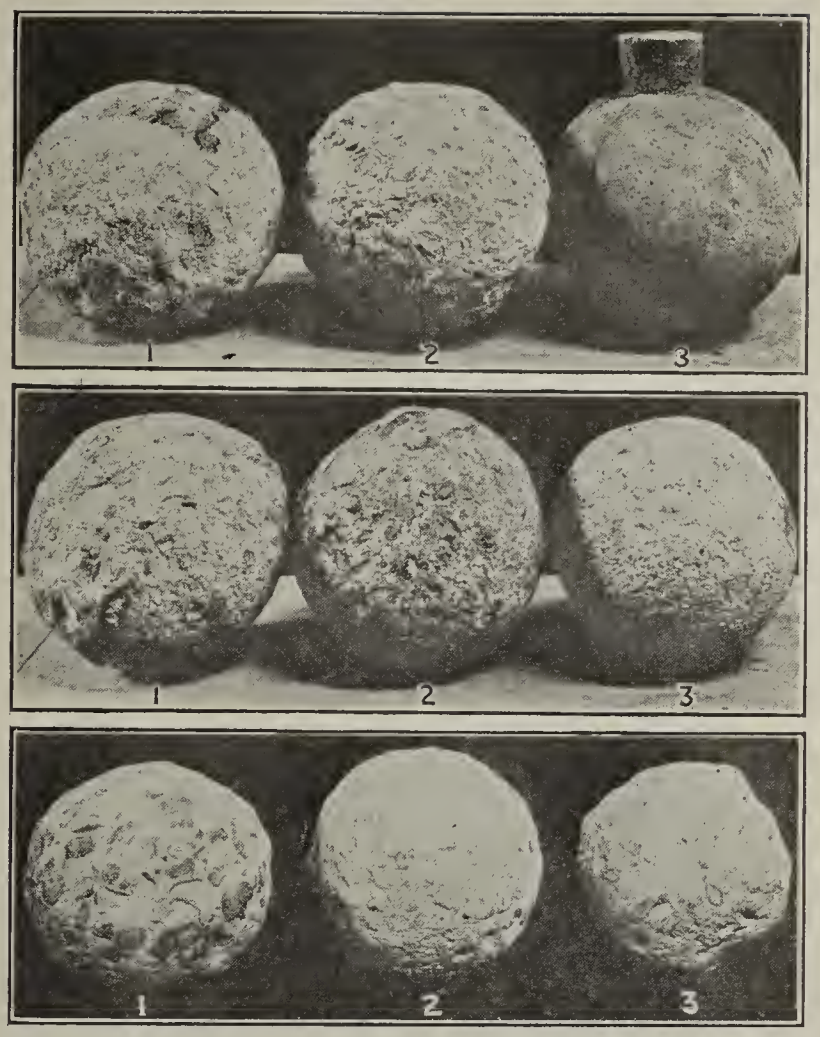
An examination of rectangular specimens after they are tested shows that a considerable portion of the loss is due to the exposed edges and that this loss is not a measure of the resistance to abrasion offered by the surface. The 9-in. spherical surface affords a very good approximation of the plane surface of

Cast-Iron Mold for Spheres

a pavement especially as it relates to its resistance to abrasion.

The use of spherical specimens eliminates the necessity of a spherical type of rattler, as they can be tested in the standard brick rattler with the standard abrasive charge.

The first spheres were made in concrete molds cast over a wooden pattern. In one-half of the mold a 2-in. gate was left, through which the concrete was poured. These molds were thoroughly paraffined and oiled on the inside and little difficulty was found in removing the forms after the specimens were cast. After it was found that the test was practical, a number of cast-iron molds were prepared and are now used exclusively



(Above) Wisconsin Granite 1 : 2 : 3½ Concrete

(1) 10.2 per cent loss; (2) 11.1 per cent loss; (3) before testing, 28 days old.

(Middle) Gravel and Chatts Concrete Compared

(1) Arkansas River gravel 1 : 2 : 3½ concrete 28 days old, loss 22.8 per cent; (2) same as No. 1, 21 per cent loss; (3) Joplin Chatts 1 : 3 concrete 28 days old, loss 35.5 per cent.

(Below) Gravel Concrete Compared

(1) Silverdale gravel 60 days, loss 11 per cent; (2) Arkansas River gravel 60 days, loss 17 per cent; (3) Arkansas River gravel 28 days, loss 29 per cent.

in casting the spheres. Considerable care had to be exercised in placing the concrete forms together so that the two hemispheres were eccentric and there was also difficulty in puddling and ramming the concrete, lest the alignment of the forms be disturbed. The cast-iron forms can be jolted and rolled to eliminate air voids and further to compact the concrete.

No difficulty is found in getting satisfactory specimens free from air pockets using concrete of proper consistency, with a slump of less than 1-in. Specimens are cast with a neck, which is left on until ready for testing when it is broken off with a hammer.

The storage and treatment of test specimens can be as seems desirable. In the laboratory, storage has been two days in the forms, nineteen days in water, and rest of the time in the ordinary dry atmosphere of the laboratory.

Because of the limited funds available for research work, no systematic studies have been made. The different tests to date have been on different aggregates using various brands of cement, so that results are not always comparable, and do not warrant the drawing of definite conclusions.

Series Nos 3 and 12 were made using the same sand and cement with the exception of No. 5, as noted. The results are shown in Table I. This was the first series of tests made. Nos. 1 and 2 were tested at 7 days and 14 days, with the result that the specimens were lost, the mortar not having sufficient strength to withstand the wear. This table shows the degree of uniformity given by each series and also the effect of

Table I. Value of French Co-efficient of Wear On Abrasive Resistance

No. of Test	Coarse Aggregate	French Coefficient	Proportion of Mix	Age 28 Days Loss in Per Cent	Average	Maximum Variation from Average	Age 90 Days Loss in Per Cent	Average	Maximum Variation from Average
3	Limestone	6.5	1:2:4	22.7, 24.1, 22.6	23.1	+1.0	9.3, 10.1, 10.6	10.0	0.7
4	Limestone	4.0	1:2:4	33.3, 39.9, 33.7	35.6	+4.3	25.8, 29.0, 24.2	26.3	+2.7
5	Limestone	4.5	1:2:4	18.6, 18.8, 18.5	18.6	+0.2	13.0, 12.2, 10.7	12.0	+1.0
6	Quartzite	13.5	1:2:4	12.2, 12.6, 13.8	12.8	+1.0	10.3, 7.6, 5.1	7.7	+2.7
7	Granite	18.0	1:2:4	7.8, 8.3, 8.0	8.1	+0.3		No data	
8	Limestone	4.0	1:2:4	38.2, 39.7, 31.9	36.6	—4.7		No data	
9	Limestone	6.6	1:2:4	16.1, 20.3, 17.2	17.8	+2.5	14.1, 20.8, 22.2	19.0	4.9
10a	Mine run chatts		1:3	21.2			23.5		
10	Mine run chatts		1:3	40.5, 35.5	38.0	+2.5	20.4, 20.5	20.4	
11	Pit run gravel 40% on ¼ in. screen		1:4	10.5, 15.5, 21.6	15.9	+5.7	8.6, 12.5, 13.8	10.6	3.2
12	Sand only		1:3	22.8, 27.1, 31.1	27.0	+4.2			

NOTES:—No. 5. A different brand of cement from others used in this test. No. 6. Coarse aggregate, too coarse for best results. No. 9. This specimen much denser than others, may indicate an error in proportions of mix. No. 10a. A well graded chatt. No. 10. Not so well graded as 10a, also a slow setting chatt.

age and the value of the French coefficient of wear on the abrasive resistance of the concrete.

Table II. Mortar Abrasion Tests on Cement of Different Brands.

	Age 28 Days, Per Cent Loss	Age 75 Days, Per Cent Loss
Brand A 1:3	37.3	25.6
Brand B 1:3	26.1	10.7
Brand C 1:3	52.0	34.3
Brand D 1:3	52.8	42.3
Brand E 1:3	31.8	20.8
Brand F 1:3	54.5	35.6
Brand G 1:3	22.4	15.4

Table II is a series of tests on mortar made with different brands of cement. This mortar was of rather an inferior quality. This shows that there is a marked difference in the wearing properties at early ages, of the mortar made from different cements, and from data on standard tests of the cement the resistance to abrasion was in practical agreement with the strength. In general, the properties which give strength might be taken as indicative of the resistance to wear.

Table III. Results From Same Lot of Cement, but Different Aggregates.

Aggregate	F.C., or Wear Value	Prop. of Mix	Loss in Per cent 28 Days	Loss in Per cent 60 Days	Crushing Strength 28 Days, Lbs.
Wisconsin Granite	18	1:2 :3½	11.1	6.8	
		1:2 :3½	11.2	8.0	3,010
		1:2 :3½	10.2	6.9	
Wisconsin Granite	18	1:1½ :2½	8.2	3.8	4,930
Wisconsin Granite	18	1:1¾ :3¾	9.8	5.9	
Mortar, Blue R. sand		1:3	33.1	24.6	2,020
Ark. R. gravel-sand	15%	1:1 :3¾	14.8	13.1	2,660
Ark. R. gravel-sand	15%	1:2 :3½	22.8	19.5	1,975
Ark. R. gravel, screenings and sand	15%	1:2 :3½	21.0	16.7	2,390
Joplin chatts and jig sand.	12 to 18	1:3 :1¾	14.9†		3,230
Joplin chatts jig sand	12 to 18	1:2 :2	13.9†	15.4	2,810
Joplin chatts Blue R. sand	12 to 18	1:3 :1¾	29.4†	22.8	2,490
Joplin chatts Blue R. sand	12 to 18	1:2 :2	15.1†	15.8	2,160
Mine run chatts	12 to 18	1:3	(35.6)*	10.8	3,960
Blue flint scr. sand	12	1:1½ :2¾	9.9	7.6	4,045
Yellow flint scr. sand	12	1:1½ :2⅞	7.6		4,740
Unscreened yellow flint-sand	12	1:1½ :1⅞	10.7		4,550

*Defective sphere. †Maximum aggregate ½ in.

Table III shows a set of results which are more comparable, as all were made with the same lot of cement. They were, however, made at different times and represent a wide range of aggregates.

The results of the tests indicate that the method of testing is entirely practicable and possessed of several advantages over other tests so far developed.

A visual inspection of tested samples indicates the desirability of a coarse aggregate of smaller size than is commonly required for one course concrete work.

It is believed that the improved wearing value shown by the richer mixes used for the wearing course of a pavement is largely due to the finer coarse aggregate used in such mixtures.

The mortar bond on gravel or stone breaking with a glassy fracture is not strong enough to permit the use of this test at ages earlier than 60 days, as at earlier ages aggregate breaks out of its bedding.

It is not believed that smaller sized spheres would be practicable. Some 6-in. spheres were cast and tried out with unsatisfactory results.

New Directory and Market Data Book

Crain's Market Data Book and Directory of Class, Trade and Technical Papers, now on the press, promises to be of unusual interest to advertisers generally and users of trade and technical papers in particular. It not only lists all of the business publications of the United States and Canada, giving circulations, rates, type page sizes, closing dates, etc., but supplies a market analysis of each trade, profession and industry. Thus the reader is given the basic facts of each line in which he may be interested, including its buying power, buying methods, character of requirements, etc. The volume, which is bound in cloth and contains nearly 500 pages, is published by G..D. Crain, Jr., 417 S. Dearborn street, Chicago. The price is $5. Orders in advance of publication are being accepted at the rate of $3.75.

Two Interesting Concrete Bridges in Oregon

Two bridges in a rough mountainous country, completed last year in connection with the road developments plans of the Oregon State Highway Commission, have attracted much attention from engineers, not because of their size or length but because of some rather unusual conditions which surrounded their construction. Both bridges are part of the highways which lead through the mountains of Oregon, one of them being located in the extreme northern part of the state right in the heart of the Cascade Mountains and the other in the extreme southwestern part of the state among high spurs of the same range. Both bridges span mountain streams, which are uncertain in character due to the rapid change not only in the depth of the water but also the velocity of the current. Both bridges were planned by the engineers of the Oregon Highway Commission, of which Herbert Nunn is chief engineer, and C. B. McCullough, bridge engineer, and both were constructed under a lump sum contract by Parker & Banfield, contractors, of Portland, Ore. We are indebted to Modern Building for the following details and illustrations of these bridges.

Rogue River Bridge. Note Fine Details of Ornaments and Moulded Hand Rail

The Hood River Bridge.—The bridge over Hood river is about 65 miles east of Portland and consists of three 90-ft. arch spans with a 140-ft. beam-and-girder concrete approach. The bridge overall is 22 ft. wide, thus providing for a 20-ft. roadway. The railing is a straight spindle moulded with a broad cap. In constructing this bridge the contractors had a favorable location, for directly next to the new bridge was an old wooden structure. In pouring the piers and foundations for the new structure the contractors put a ½-yd. hopper on an old automobile, and by running it back and forth from the mixing plant, at one end of the bridge they made rapid progress in pouring the piers and footings by shooting the concrete from the automobile on the old bridge into the forms. When it came to pouring the arch rings and roadway they erected two towers and spouted the concrete from these into the forms.

The form work for the arch rings was built up from the river bed, some sections being trussed over so as not to interfere with the normal flow of the stream. On account of rapid changes in the stream all this work had to have extra bracing, for once or twice during construction, due to sudden storms in the mountains, the stream rose as much as 16 ft. and covered the piers.

This bridge contained 1,012 cu. yds. of Class A concrete, 241 cu. yds. of Class B and 647 cu. yds. of Class C. There were 93,500 lbs. of reinforcing steel and 632 lin. ft. of handrail. The total contract price was $40,276 and to this there was added $7,219 paid by the state for work on the approaches and $1,804 for engineering and inspection, making the total cost of the structure, $49,300 or $7.75 per square foot of road surface.

The Rogue River Bridge.—One of the most interesting pieces of work was that of the bridge over the Rogue River near Gold Hill, about 300 miles south of Portland, known now on the highway maps as "Rock Point Arch." It consists of one 115-ft. arch span with six 25-ft. approach spans on one end and seven on the other, making the total over-all length of the structure 540 ft. The topography of the country at this point is such that it provided a wonderful setting for a beautiful structure, and Bridge Engineer McCullough in his design kept this in mind. While the surrounding country provided the necessary crushed stone it was found that suitable sand would have to be provided from a point 12 miles distant.

While the Rogue River is narrow at the point where

the bridge is located, it has great depth, being more than 40 ft. deep, with swift and uncertain under currents, therefore it was impossible to figure on any false work supported from the bed of the river. To overcome this difficulty, Mr. C. J. Parker of the contracting firm, designed a Howe truss to carry all the form work of the arch span. First of all a raft was constructed in the river and securely tied to the banks with heavy wire cables, and upon this raft was built the Howe truss. This truss carried the entire load of the forms and the structure.

In designing this truss it was figured for a deflection of 1¾-in. when the entire load of the wet concrete had been placed. Just before the arches were poured, all members of the truss were drawn up tight, and upon the completion of the bridge so accurately had the loads been calculated that there was only a variation in one arch of ⅛-in. of the figured level and in the other a variation of only ⅜-in. of the established level. Each arch ring was poured in one day. Each ring contained approximately 80 cu. yd. of concrete and each end was poured alternately so that at all times the work was kept nicely balanced.

The Rogue River is a very treacherous stream at

Rogue River Bridge Showing Truss Supporting Arch Span After Forms Were Partially Removed

Length View of Rogue River Bridge Showing Detail

this point as it comes down through a narrow pass in the mountains and is subject to not only quick changes but also to great velocity. During the work it sometimes rose as much as 6 ft. in a few hours, coming up to within a few inches of the bottom member of the truss carrying the false work.

The bridge is highly ornamental with a very finely moulded hand rail and a dental course moulded along the entire length of the bridge with ornamental brackets at each column and strut.

The bridge contains 969 cu. yds. of concrete, 151,429 lbs. of reinforcing steel and 858 lin. ft. of hand rail. The total contract price was $46,930, to which should be added $1,463 for engineering and supervision, making the total cost to the state $49,393 and as the bridge is 540 ft. over all in length with a 20-ft. roadway, an average of $7.90 per square foot of roadway.

Hood River Bridge—Three 90-ft. Arch Spans and 140-ft. Beam and Girder Approach

Hydrated Lime In Concrete Pipe

The concrete block and pipe industry is growing by leaps and bounds. Small plants are springing up all over the country, and the use of their product is steadily increasing. In many instances the facilities for manufacture are not all that might be desired, but the live manufacturer keeps on the job and overcomes his difficulties.

Obtaining the proper consistnecy of the mix is one of the problems that confronts the producer. If he makes the mix too dry, it will not pack well and the pipe will be porous. If he makes the batch too wet it is extremely difficult to handle and the product is weak. Hydrated lime added to the mix practically eliminates these two troubles for a concrete that is dry enough to attain high strength and yet plastic enough to be easily workable is attained. No only are these essential results secured, but also the produc can be made permanently watertight, which of course is greatly desired.

The office of the California Associated Concrete Pipe Manufacturers writes:

"We can say, however, that the addition of about 5 per cent of hydrated or slaked lime with the sand cement mortar that is used for connecting the joints of concrete pipe is a material help, addition of lime giving a greater plasticity to the laying mortar and especially desirable for laying pipe in hot weather as ordinary sand mortar will set too quickly to give a perfect joint.

"A great many pipe manufacturers in California add lime to the aggregate when mixing concrete. They claim that this makes it easier to get the proper consistency for pipe."

Hydrated lime has proved its worth to many manufacturers, and those who are not now using it will soon take advantage of its merits and effect a material saving in their cost of production, as well as securing a better product. Recommended proportions for the unusual mixes will be found in Bulletin 302 and Pamphlet 353, sent free upon request by the National Lime Association, Mather Bldg., Washington, D. C.

Traveling Cranes

The Northern Engineering Works, Detroit, has put out a beautifully illustrated little booklet, showing the various types of electric hoists that it manufactures. These are of all styles and capacities, and suited for every line of industry. One type, for instance, that would seem particularly well suited for stone sheds, is cab-controlled and travels from crane to monorail tracks so that it can cover an entire plant and other type built especially for crushed stone, sand, gravel and cement plants is equipped with grab bucket.

20-"Year" Tests of Cement and Mortar Materials

Long-Time Tests of Portland Cement, Hydraulic Lime and Volcanic Ashes, I. Hiroi. Data of two series of tests covering a period of more than 20 years. Some of the cements used for the first series of tests were manufactured by the old process of burning in so-called "bottled" kilns, while those in the second series were produced in modern rotary kilns. Another series of tests is also under way which it is proposed to extend over a period of 100 years.

The following are some of the conclusions arrived at by the author:

In sea water neat-cement briquets attained maximum strength in the course of less than a year, after which they rapidly declined, in some cases completely losing their tensile strength in four or five years. The author ascribes this peculiarity to excessive crystallization, which makes the structure highly brittle. While losing their tensile strength almost entirely, these briquets retain their form and also show considerable amounts of compressive strength, which latter, in fact, possibly even increases while the tensile strength decreases.

Cement-sand mortar mixtures in the proportion of one part of the former to two parts of the latter in air and sea water show progressive increase of strength with age, the air curves running much higher than sea-water ones. The mean results apparently follow more or less closely hyperbolic curves (for which equations are given in the original paper), which would place the eventually attainable tensile strength of such mortar in air and sea water at 85 and 50 kg. per sq. cm. (1210 and 710 lb. per sq. in.), respectively.

Tests were also made to determine the influence of the kind of sand used for mortars, and it was found that while standard and coarse sands produced practically equal strength, fine sand was found to be decidedly inferior in air, fresh water and sea water, both in tension and in compression.

As regards the strength of mortars in sea water, it was found that the lower the proportion of sand in the mortar the stronger the latter will be.

The results, however, have also suggested the possibility that in mortars to be used in sea water an excess of cement is to be avoided as much as a deficiency. A proportion richer than 1:1 is too costly and one lower than 1:3 may have voids; the proportion of 1:2, on the other hand, has little more cement than is sufficient to fill up all the interstices in the sand.

Tests on the effect of curing in fresh water on the strength of mortars kept in sea water have not indicated any definite and material improvement due to curing.

An interesting series of tests was made on the use of volcanic ashes in cements, the ashes used being of Jananese origin exclusively. In air tests it was found that the greater the amount of ashes used the lower the strength of the briquets, and none of the ash-cement mortars had a strength equal to that of the straight cement ones. On the other hand, in sea-water tests the superiority was decidedly on the side of the ash-cement mortars, which are, however, weaker than straight cement mortars in compression.

The action of volcanic ashes when used in a cement mortar appears to be twofold, viz., mechanical and chemical. Mechanically, the ashes increase the density of the mixes, making the latter more or less imeprmeable to sea water; chemically, the combination of silica with free lime in cement, which makes the latter unassailable by the sulphates contained in sea water, seems to be the most important action. The activity of silica contained in ashes naturally depends on the state in which it is present; and while there is no doubt that the soluble portion is the most active agent, the total amount of silica should also be taken into consideration. Thus, the Otaru ashes, which according to the analysis contain the least amount of soluble silica of the three but the largest amount of the insoluble one (on an average of 61 per cent in the Otaru ashes, 47 per cent in the Yochi, 34 per cent in the Goto), produced higher strength than either of the other two ashes. That a portion of insoluble silica enters into combination to form soluble compounds in course of time is shown by the several analyses made of (Otaru) ash-cement mortar block kept in sea water, the results of which are given in the following table:

	Silica (Total 100)	
Time of Analysis	Soluble	Insoluble
Before induration.....	43.73	56.27
2 months.....	46.28	53.72
7 months.....	47.29	52.71
14 months.....	50.08	49.92
38 months.....	53.95	46.05

The value of volcanic ashes, as an ingredient in a cement mortar is possible of direct determination by testing the combining power of the ashes with lime. (Journal of the College of Engineering, Tokyo Imperial University, vol. 10, no. 7, 1920, pp. 155-172 and 10 plates, e.)

Sauerman Power Scraper

The operating principle of a Sauerman Bottomless Power Scraper is very simple. The scraper is just dragged back and forth between digging point and dumping point by a double-drum friction hoist.

The front drum of the hoist operates the "load" cable which leads through sheaves from the front drum to the bridle chains on the front of the scraper. The "pull-back" cable leads from the rear drum through guide blocks located at the far end of the excavation and is then attached to the rear bridle chains on the runner frame of the scraper.

When the scraper is at the point of digging the operator throws in the friction of the front drum and disengages the friction of the rear drum. This puts the "load" cable into operation which pulls the scraper forward and causes the cutter edge to dig, the material thus loosened filling in between the two side plates of the scraper. The loaded scraper is then pulled over the ground at a speed of about 200 feet per minute to the point of dumping. When the scraper reaches this point, the operator disengages the front drum and throws in the friction of the rear drum, putting the "pull-back" cable into operation. Being bottomless the scraper leaves its load at the point where it starts its backward travel.

The digging radius of a Sauerman Power Scraper is limited only by the length of the operating cables, but it is not generally economical to exceed an operating span of 500 feet in handling sand and gravel. Spans up to 300 feet are most favorable.

Where the smaller sizes of Sauerman scrapers are being used, one man generally handles the entire operation of the equipment, acting both as engineer and fireman.

Experiences with Thin Concrete Slabs*

By JOHN V. SCHAEFER,

President, Cement Gun Construction Co.

In 1916 the Cement-Gun Construction Co. was doing some work for the Ford Motor Co. at Detroit. One day the architect asked us to help him solve this problem.

One of their main buildings, known as Building A, is about 85 ft. wide and 900 ft. long. The building adjoins the power house, and in building it they planned to use the roof for a spray pond for cooling the cooling water of their big gas steam engine. To that end they built the roof in bays about 85 ft. square. Each bay was dished to the center about 18 in., with a uniform slope from all edges to the center, where there is a sump about 20 in. square, from which a cast iron pipe conducts the water back to the pumps.

The roof has a 6-in. concrete slab. Along one edge of the roof was a parapet wall. The other edge was flat. The surface was not all even; in some places where hangers had been required in the room below, holes had been cut through the roof for the hangers and the hose patched and the hangers mounded over. In addition, some of the bays had pent houses covering heads of elevators, and the brick piers for supporting the spray pipe had been placed right on the roof.

A few bays of this roof which had been put into service had been covered with a membrane roofing many plies thick. In some places the total thickness was as much as 5/8 in. This membrane was made continuous over the ridges between bays and flashed along parapet and around piers and pent houses.

The sprays were in use pouring hot water on these roofs from Monday morning until Saturday night—over Sunday they were shut down, so that through the week they were subjected to nearly boiling hot water, and over Sunday they might be subjected to a temperature of 20° below zero. Under these conditions the membrane had gone to pieces and the matter was a serious one, as the room below was used for such purposes as pattern shop, dynamo winding, moving picture laboratories, etc., and of course any leakage through this roof was a serious matter.

We were asked whether we could shoot a waterproof coating of gunite on these roofs and make them tight. Here was a problem. The underside of this roof slab was at a fairly constant temperature the year round. The top surface had a weekly temperature range from about 200° above zero to 20° below zero. We figured that any concrete coating applied to the top surface of these roof slabs would have to crack on account of contraction and expansion. Our suggestion was to place on the roof a thin gunite slab heavily reinforced, and so placed that it would not be attached to the concrete roof slab at all.

We were given an order to treat two sections in accordance with our theory. We first mopped the surface with pitch. We then placed a double layer of No. 7-A American Steel & Wire Co.'s triangular mesh, with main wires at right angles and with end and side laps securely tied. Over the ridges between bays we built curbs 8 in. high split through the center so as to make an expansion joint, and over the top of the curbs we placed a galvanized iron cover with the edges bent down about 2 in. to prevent the spray from falling into the open joint. This gave us a sort of a shallow pan or basin, 85 ft. square, 18 ft. lower at the center than around the edges, and with free ends all around the parapet wall.

These two were fairly successful. However, some small cracks did open and there was some slight leakage. We never found out exactly where the leakage came from. The cracks seemed to be surface cracks only and we never believed that they caused the leakage. However, the work was so satisfactory that the rest of this roof was done in the same manner, and has been in continuous successful use for several years.

When a year later four additional bays were built we covered these in the same way, except this time we saw to it that these roofs were left smooth, without any obstructions, and the brick piers were built on top of our gunite basin, instead of projecting through them. Furthermore, this time we supplied more reinforcement and we were more particular about preventing a bond between the roof slab and the gunite. We first placed a 1/2-in. layer of dry sand all over the roof. On this, to prevent blowing it away with our cement guns, we placed a thin layer of tarred felt. Over this, with suitable spacers, we placed our double layer of wire mesh, and in addition a 1/4-in. square rod 18-in. centers in both directions. Through this we shot a 2 1/2 in. layer of gunite. These basins never even showed a hair crack, and we believe that we successfully accomplished what we set out to do, namely to build shallow basins floating on a layer of sand, which were free to contract and expand independent of the roof, and which were so heavily reinforced that they would come and go with contraction and expansion without cracking. These roofs never leaked.

Now a word as to the theory on which we proceeded. The co-efficient of expansion of concrete and of steel is the same to within a very small fraction —so small that for work like the above the difference is negligible. If a slab like the above is free to move, there is no reason why expansion cracks should occur. The center was anchored by the sump; the edges were free to come and go, except for the friction, and as this friction on a large area would be very great, a sufficient amount of steel was needed to actually pull and push the slab as it contracted and expanded. In the case of a slab held fast at the ends or at intervals like the wall of a building, such a slab cannot come and go at will. When contraction occurs there is a shortening of the structure, and if the ends cannot move toward each other then this shortening must be taken care of by a crack, as concrete will not stretch, and somewhere about 300 lbs. per square inch, it suddenly gives sway. Such a slab simply cracks in one or more places at the weakest spots, the sum total of the width of the cracks being equal to the total amount of contraction.

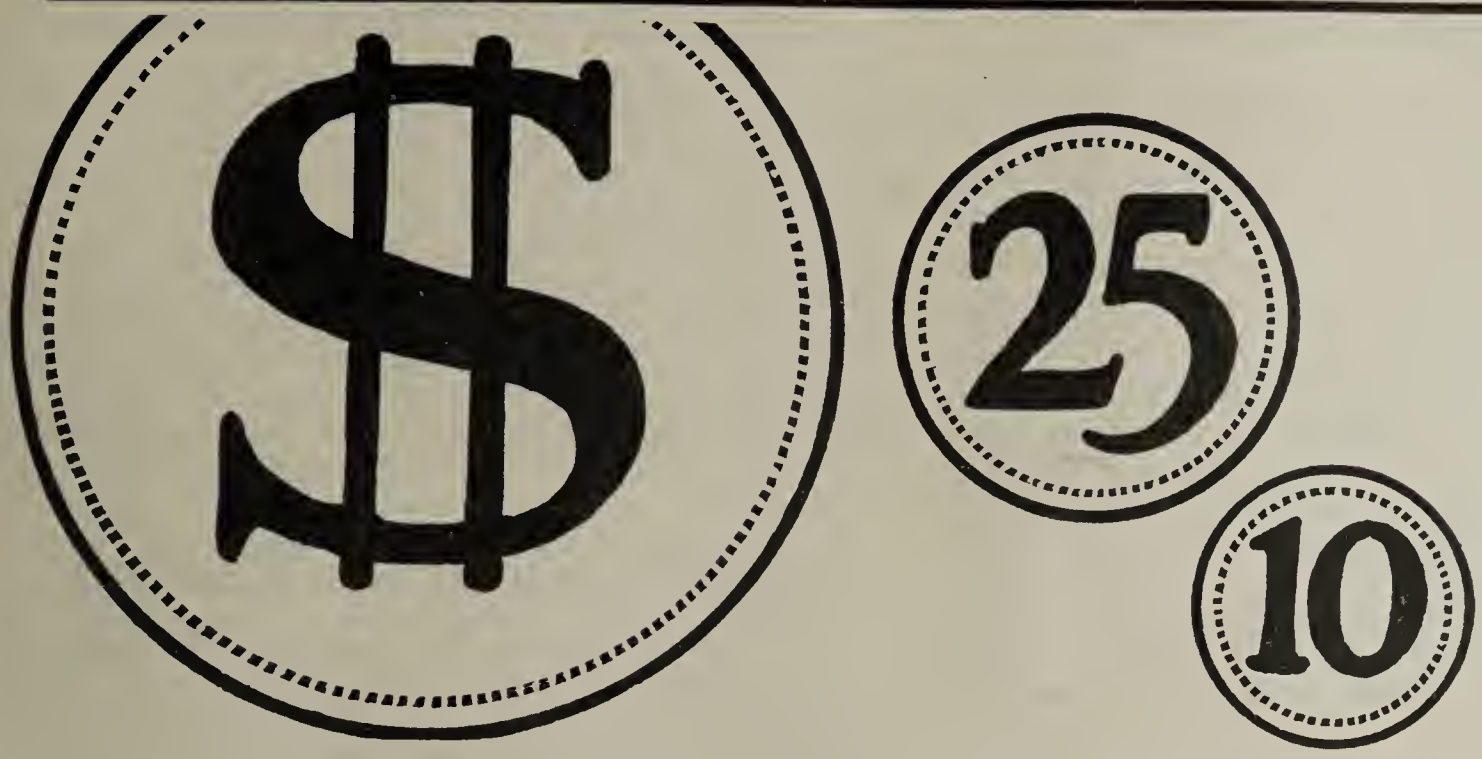
Steel, on the contrary, stretches approximately in proportion to its stress up to a certain point called its elastic limit. Now, assuming roughly that concrete will stand 300 lb. and that at 10,000 lb. steel is stretched but a very little, if we give a slab steel reinforcement equal to 300÷10,000=.003 as much cross section in steel as it has in concrete, we have a slab which when it contracts will not crack in one or two places. Every fractional inch of its length will stretch the exact amount of that fractional inch of steel. We will not have a few visible and dangerous cracks; we will have millions of microscopic cracks, none of them wide enough to ever let water through. It is upon this theory that we have proceeded, and our success thus far has been gratifying.

$ ==

1/3 more per dollar

DU PONT

DUMOR



Your explosives dollar is now worth $1.35

DUMORITE comes with 135 to 140 1¼ x 8 sticks to the 50-lb. case—regular 40% dynamite has 100 sticks to the case.

The price is the same per case.

Dumorite, under ordinary conditions, does approximately the same work as "40%," stick for stick.

In addition, Dumorite is a guncotton-nitroglycerin dynamite *without a headache.*

And Dumorite is non-freezing at any temperature.

Are these advantages in cost and efficiency enough to justify ten minutes of your time—the time it will take you to write our nearest branch office outlining the requirements of your particular work?

Our Service Department has been able to show a great many operators that Dumorite will do their work better or equally well and at a materially less cost.

Probably you, too, will be able to save money by using Dumorite.

Branch Offices:

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Huntington, W. Va.
Kansas City, Mo.
New York, N. Y.
Pittsburgh, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
Springfield, Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

ITE NON-HEADACHE NON-FREEZING

Money-Making Mixers

In this day and age, time is money. If you live in a community where labor is hard to get or where the cost of labor is high, and you find that your concrete construction work is costing you more money than you think it should, you will grasp eagerly at the chance to perform a greater amount of work at a smaller cost, if such a thing is possible. Here is where the efficiently designed concrete mixer is a very important machine for you to own. With a mixer, the amount of labor required is less, it takes less time to do this labor, and you can do more work at an additional profit, as compared with what you have previously done.

In another instance, we shall assume that you have a competitor, and that he is pushing you hard in the field. If you buy a mixer and he uses the hand method, you will be able to give your patrons better work, and you will also be able to take work for less money than

he can afford to take it at, since you will be able to do the work quicker and at a greater profit.

The accompanying illustration shows the "Jaeger" concrete mixer made by the Jaeger Machine Co., 212 Dublin St., Columbus, Ohio. This machine is driven by gasoline engine power, and is equipped with a side loader operated by the same power. In the instance shown, the machine has the side loader filling the drum.

A noticeable point in connection with this mixer is that the engine is completely housed with a steel housing to keep out dust, dirt, and cement from the working parts.

The "Jaeger" is very light running, and the drum can be swung from one side to the other with very little effort. The drum is so placed that it balances perfectly, and it is not necessary to lift the entire weight of the drum and material in swinging it from one side to the other. The engine can be started by simply turning on the gasoline, lubricating oil, and the battery, and then turning the crank. The mixer can be stopped instantly by turning off the battery. The machine may be loaded while the drum is revolving, and may also be dumped without stopping the drum. The drum can be stopped by throwing over a clutch, without stopping the engine.

The Jaeger Machine Co., can furnish you with practically any size of mixer that you feel need of in your work, and will be glad to take up the matter of type of mixer and size of same with you if you will drop them a line. They will also be glad to send you information and catalogues of any kind in connection with their line of machinery if you will ask for them.

Corn Crib Block Machine

The Anchor Concrete Machinery Co., Rock Rapids, Iowa are manufacturing a very efficient machine for making blocks for silos or corn cribs. With the corn crib block machine you can make two blocks at one operation. The blocks will lay in the wall approximately 24 inches in length, 8 inches in height and 4 inches wide. Each block is equipped with a continuous groove large enough to receive a ¼ inch or larger reinforcing; quarter inch reinforcing we guarantee and recommend will be abundantly strong for any corn crib.

A corn crib 18 feet in diameter and 24 feet in height holding 2,500 bushels of corn is a satisfactory size. However, you can use the same blocks and build a

Anchor Continuous Air Space Silos Are Frost and Moisture Proof. Note the Continuous Groove in the Block to Receive the Reinforcing

crib any desired radius you see fit or any height. An ordinary 40 feet farm elevator can be used in filling the corn crib.

The corn crib is equipped with manhole on the roof similar to manholes in silos. Two men tamping blocks by hand and the concrete being furnished by others will make easily 400 blocks per day. By the use of Anchor Automatic Tamper the output can be increased up to 1000 blocks per day.

In the corn belt sections of the country every owner of an Anchor machine should buy the attachments necessary to make these corn crib blocks. To owners of regular Anchor block machines, that do not have their silo attachments, the Anchor Company will furnish the complete mold box to fit the regular Standard Anchor machine at a reasonable cost.

Boiler Setting Permanent and of Low Cost

By G. W. Johnson, Phelps, N. Y.

In Contractor's Atlas

It is the general practice in writing of concrete structures to describe them at the time of building and then to take as a matter of course the permanence and years of service that concrete gives, so that very seldom do we see any articles describing the results after years of actual use.

Therefore, the readers of Contractor's Atlas probably will be interested in knowing of the satisfactory service given by the concrete boiler setting erected under my supervision, as superintendent of the work, 14 years ago. The boiler is a 100 h.p. horiziontal return tube type. Because of the high cost of brick setting, we decided to employ concrete. We secured very gratifying results; both in low cost—one-half that of brick—and also in very satisfactory wearing qualities.

For the sake of appearance the forms were arranged so as to mark the walls off into blocks 38 in. long and 17 in. high. Hollows were provided in the walls by means of 24-Gauge sheet iron cores, 5 in. in diameter, and spaced 18 in. on centers. These air passages extended from the bottom to top of wall; air being admitted at the bottom through 2x4 in. holes. The concrete was mixed 1 sack of Atlas cement to one-quarter cu. yd. of gravel screened through a 1-in. mesh.

In pouring the walls, the concrete was carried up in courses 17 in. high, no reinforcing steel being provided. The thickness of walls was 22 in. at the bottom, this thickness being decreased toward the top by battering the walls inside, in the same way as is customary with brick boiler setting walls. Where the walls would be exposed to very strong heat, they were faced with firebrick.

A remarkable test of a cement-clay mixture for resisting high temperatures is shown in the front and back furnace arches. The back arch was made of a mixture of 1 part cement and 10 parts of clay, composed one-half of brick clay and one-half of fire clay. The cement clay mixture was made thin enough to pour in over a wooden centering covered with tar paper. *This original arch is still in place.*

The front arch over the firedoors was originally installed of the pattern burnt arch type, made in large sections, with a firebrick pier between the firedoors. This arch went down in about two years, and we then replaced it with the same cement-clay mixture of which the back arch was made. This front arch has been in continual use for eight years and intermittently for three years. Today upon inspection it was still in good condition.

The boiler setting has been inspected by a number of experienced contractors and also by various boiler inspectors and today stands, in the opinion of the writer, as a proof of the superiority of concrete over brick for boiler settings.

Annual Proceedings Volume 21 Now Ready

Vol. 21 (1921) annual Proceedings of the American Society for Testing Materials is now off the press. This volume comprises 1197 pages and contains the annual reports of 31 of the standing committees of the Society and 24 technical papers, together with the discussion on these papers and reports. It also contains 93 tentative standards which have either been revised or are published for the first time; the annual address of the President and the annual Report of the Executive Committee.

The technical papers contain valuable information on results of investigations by experts in the field of engineering materials and the reports of the committees cover Ferrous and Non-Ferrous Metals, Cement, Ceramics, Concrete, Gypsum Lime, Preservative Coatings, Petroleum Products, Road Materials, Coal and Coke, Electrical Insulating Materials, Shipping Containers, Rubber Products, Methods of Testing, Metallography, and Nomenclature and Definitions.

The volume is available at the following prices: $10.00 in paper, $11.00 in cloth and $12.50 in half-leather binding. Sent on receipt of price by American Society for Testing Materials, 1315 Spruce St., Philadelphia.

Practical Concrete Roofing Tile

Cement roofing tile are not used half as much as they would be if their protective value, durability,and economy were better understood. The difficulty heretofore seems to have been to get a tile at reasonable cost that would "stand the racket" and still give good service under exposure to severe weather conditions such as sometimes prevail in this country.

L. Hansen Co., 3617 East 23rd St., Kansas City, Mo., are manufacturing a Roofing Tile Machine that seems to solve this problem satisfactorily as judged by the lasting qualities, strength, and cheapness of the tile produced. That very attractive effects are possible with this type of roof covering, is demonstrated by the tile-covered buildings shown in their catalog and that the claims of the manufacturers are fully sustained by the quality of their work, is shown by the fact that they have built up a large business, not only in the line of their machinery, but also in the manufacture and sale of the cement products made on these machines and in the actual construction of hundreds of residences, factories, and other buildings in various parts of the country. Their machines make tile of various sizes up to factory roof size, 30-62 in.; also Spanish or S-shaped tile.

Rubber Belts for Heavy Duty Service

During the past year the Cincinnati Rubber Mfg. Co., Cincinnati, Ohio, has built a 55x260 ft. addition to its plant and increased another part three stories, the addition giving a 200 per cent increased capacity.

The company is producing for the sand and gravel and crushed stone industry the Pacemaker friction surface belt for transmission and heavy duty service and extra cover conveyor belts, the Hontas, Arno and Pacemaker. This company also makes Sandow sand suction hose and Arno dredge sleeves.

The Largest Single Shipment of Blast Hole Drills Ever Made

"Eleven years ago the Michigan Limestone and Chemical Co. of Rogers, Mich., bought one No. 14 Cyclone Non-Traction Drill. As the company expanded other drills were purchased, but it happened that they were not Cyclones," writes the Sanderson-Cyclone Drill Co., Orrville, Ohio.

"Carefully kept records over a long period showed that the No. 14 Cyclone the oldest machine on the job—drilled 20 to 30 per cent more holes than any other one drill in the quarry, or the best average of sixteen other drills, even taking into consideration new drills that were purchased from time to time.

"As to upkeep costs—the Cyclone repair and renewal costs were practically nothing as compared to the other drills. It was the custom of the Michigan Limestone and Chemical Co., to take the drills into the Machine Shop and overhaul them each winter during the shut-down period, but the Cyclone never came off of the top of the cliff—it needed no rebuilding.

"Late last summer the Michigan Limestone and Chemical Co., purchased one No. 14 Cyclone Electric Traction Drill of latest model for the purpose of testing it out. Without going in the details of the results obtained with this new machine, it is sufficient to say that they were so remarkable as compared with all former results that thirteen additional electric traction drills were ordered to replace all the old drills with the exception of the old Cyclone (the first drill on the job), which will be used and is still good for several years of service.

"Our Catalog B-46 'Big Blast Hole Drills' was prepared for the purpose of giving quarrymen information that would assist them in lowering their stone costs. It contains semi-technical information on drilling and operating methods and drilling cost data, as well as a complete description of Cyclone Drills. Ask for a copy."

Cement Block Men Organize

The cement block manufacturers of Jackson, Mich., organized and will be known as "The Jackson Concrete Products Association."

Officers were elected as follows: President, George W. Rountree; vice president, C. S. Lowe; secretary and treasurer, C. E. Willbee.

The object of the association is to build up a better block trade mark it, make it a tested unit and have it recognized as fire safe, that it will comply with the building code authorized by the city.

The charter members are: E. J. Watters, J. A. Crownover, R. B. Emerson, G. W. Rountree, C. S. Lowe and C. E. Willbee.

C. Dever, of the Detroit office of the Portland Cement Association, was present and helped materially in bringing about the organization. He pointed out very strongly the necessity of putting a tested and fire safe block upon the market.

Hydrated Lime for Concrete

Business with the Western Lime Company, Denver, Colo., is good. This company are producers of hydrated lime, crushed limestone for fluxing, railroad ballast, road construction, concrete aggregate and fertilizer. They have doubled the capacity of their plant during the past year and will soon have to double again to keep up with the demand for their product. Four aims have guided them in the development of their business. First to manufacture a product of only standard tested quality. Second, to keep production a step ahead of demand. Third, to use the most efficient equipment possible. Fourth, to advertise consistently and maintain a selling organization that will keep their production department going at full speed twelve months of the year.

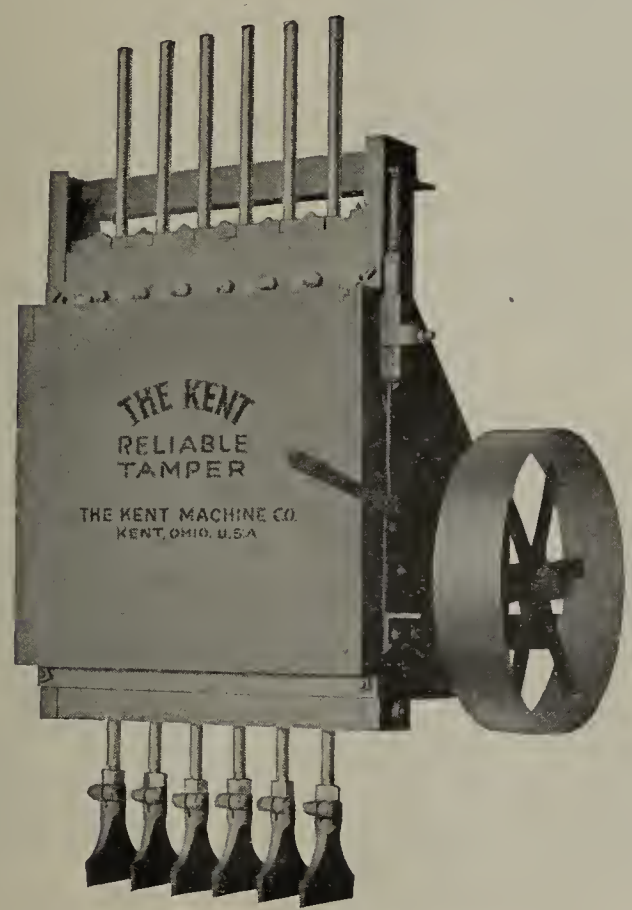
They have not had a dull day in the last three years. Business is always good because their selling organization is on the job all the time and because they are able to produce products of reliable quality at a reasonable price, due to their efficient organization.

The contractors, architects, manufacturers of concrete blocks and tile, builders and engineers in their territory are encouraged by them to use hydrated lime for better concrete and stronger mortar. Hydrated lime increases concrete density by virtue of its ability to fill the voids. The mass becomes more watertight—practically impervious to water. Honeycomb and other structural weakness are also prevented. Hydrated lime promotes intimate contact of the concrete mass with the forms and produces smooth, pleasing exterior surfaces.

The Kent Reliable Tamper

By A. B. Babbitt.

It has been our purpose in designing the Kent Reliable Tamper to produce a machine that would be strong and substantial in construction and which would have wearing qualities so that the repair bill would be reduced to a minimum. A tamper must be designed to withstand not simply the wear of the working parts upon bearings and guides but also the shock and blow that is delivered back to the machine



Tamper with Covers in Place

through the tamper foot coming in contact with the material to be tamped. This requires a very rigid and solid mechanism, and all of these facts have been taken into consideration in the construction of the Kent Reliable Tamper.

The tamper rod guides are long and rest in ball and socket bearings which make them self-adjusting, thereby allowing full freedom for tamper rod to fall. The rotating arms are made with a double web so that the roller gets a bearing on each side, thereby eliminating any tendency for the stud upon which the roller turns to bend down under the blow of the roller against the tamper lifting foot. The shock of the crank roller hitting the tamper lifting foot is reduced and absorbed by a shock absorbing device which is attached to each lifting mechanism. This not only reduces the shock and obviates a tendency to loosen the joints of the frame but also reduces the amount of noise which the operator must withstand during a day's run. The crank is large in diameter so that there can be no bending action here and runs in self-aligning bearings which are ample in length to last during the lifetime of the machine. The pulley is turned and accurately balanced in order to reduce vibrations from this source. The shock absorbing mechanism is of steel and is so designed that all replacements may be made in a very simple manner at the plant. The guide for the tamper lifting foot to keep it in alignment consists of a small block fitted into a yoke of the tamper lifting mechanism so that when wear in this part takes place, simply this small block needs to be replaced, thereby saving the expense of an entirely new lifting mechanism.

The hold up mechanism is very simple in construction and is so designed that by a simple pull of a lever all tampers may be operated and by letting go of the lever everything locks into place. The operator simply has to let go of the lever to be insured that everything will stop in the highest position.

Heavy protection springs are used for taking the shock should a tamper foot be dropped with no material in the box and these springs will withstand all the amount of abuse that comes to a mechanism of this character without flattening out or setting. The hold up mechanism latches are of steel to insure long wear. The frame is solidly hot riveted together with heavy gusset plate connections to insure long life under the conditions of operation. All parts of this machine are guaranteed against faulty workmanship or material and we agree to replace, free of charge, any parts that may break.

The Kent Reliable Tamper has been in operation in a block plant for the last three months and has been tested out to the full and complete satisfaction of the block manufacturer as well as the Kent Machine Co., Kent, Ohio, the manufacturers. It has been examined by a number of experts in the manufacture of concrete blocks who have invariably made remarks which could be summed up in the one statement. "This is not an ordinary tamper but a real machine."

Freight Rates

On account of the high freight rates, much sand and gravel is being obtained from wayside pits. Quality is being sacrificed as these pits do not have the facilities of the established commercial plants for proper preparation of sand. A plasterer in order to save $8.00 freight on $4.00 worth of sand recently paid out $100 for spoilage of job through poor quality sand.

The cumulative cost of all freight charges in the average building including freight paid on all raw materials used in production of construction materials and mechanical equipment is next to labor, the largest item of cost of construction. This freight cost will run from 8 to 15 per cent of the total cost depending on the type of structure and location with respect to the producing points.

Concrete Fence Posts

The Concrete Equipment Co., 540 Ottawa St., Holland, Mich., have made a record during the past year in the sale of their molds for making concrete fence posts. Now is the time to start making concrete fence posts. There is more profit in the sale of a concrete post than in a concrete block—many farmers delayed putting out posts on account of the war, the company declare. Now they need posts and are demanding concrete. Concrete Equipment Company's post molds cost very little and with proper care lasts a life time. For many years they have been used by railroads, farmers, parks, house owners, cemetaries, municipalities and ranchers. Their system is the most satisfactory and economical, lowest in labor cost and simplest to operate. Their catalog answers all questions, even some that you don't think of now.

News of the Cement Mills

The amount of lime rock contained in the large limestone deposit, known as Jameson Mountain, recently purchased by the Monolith Portland Cement Co., Morolith, Calif., is ten times larger than that of the deposits now available to other cement mills in California, and of such excellent and pure quality that it will produce, without question, the highest quality of cement possible.

It is practically free from magnesia and runs from a 100% pure lime (calcium carbonate) to a natural combination of lime, silica and alumina, requiring practically no blending for manufacturing into cement.

With the installation of a new kiln—in addition to the three kilns now at the plant—having a diameter of 11½ ft. and a length of 200 ft., the Monolith Portland Cement Co. will have a capacity of 3000 bbls. per day.

This will enable it to take care of the ever increasing business, which in the past they have not been able to do.

Beaver Portland Cement Co., Gold Hill, Ore., is installing a 15-ton Link Belt locomotive crane in its plant to handle lime rock, which is being quarried at Zacher. The primary object is to pile the rock in storage to eliminate delays at the main plant when trouble arises at the quarry. Plans to use the big crane, which is being equipped with a 50-ft. boom and clam shell bucket, to store cement clinker for aging and also to handle gypsum, will probably be put into execution next summer when rock storage will not be needed. The company's plant at present is idle, with the cement storage bunkers filled and the plant is being overhauled. Full operations are expected to begin shortly after the first of the year.

A. R. Frey has resigned his position as superintendent of the Gilmore Portland Cement Corp., Gilmore City, Ia.

George Roth, superintendent for the Pennsylvania Portland Cement Co., Nazareth, Pa., has moved to New York state to take charge of the company's recently acquired plant.

Texas Portland Cement Co., Dallas, Tex., has added one No. 85 F. L. Schmidt wet koninuter, one 5 by 22 ft. tube mill and four reinforced concrete agitating basins of 1,000 bbls. each. Four old 8 by 125 ft. kilns have been dismantled and replaced with 8 and 9 ft. in diameter by 220 ft. kilns, with three concrete stacks and three coolers. Steel and concrete have been used throughout in construction. The third kiln was started operating December 1, and the Dallas plant is now showing a full capacity of 3,000 bbls. per day.

The cement plant of the Beaver Portland Cement Co., Gold Hill, Oregon, will resume operation next Monday with a crew of more than 100 employes. The present closedown for repairs, since December 1, has been the shortest in the history of the plant. During the closedown about 75 men were employed making repairs and operating the lower quarry at Zacker.

With a large supply of cement in the storage bunkers, shipment of orders was uninterrupted during the closed period.

Work has been started on the construction of a modern cement plant, on the property of the Signal Mountain Portland Cement Co., near Chattanooga, Tenn. Detailed plans for the building of the plant have been completed and construction work is under the supervision of A. C. Deer, who is also general manager of the Peninsular Portland Cement Co., of Cement City, Mich. The plant will have a capacity of 5,000 bbls. of portland cement per day, and it is estimated that the work of building will furnish employment for about 300 men.

According to statements attributed to Mr. Deer, the plant will be the most modern cement plant in the South, since no cement plants have been constructed in that section within the last 10 years, during which time science has made many strides in the matter of cement plant machinery. It is estimated that the expense of running the new plant will be reduced materially as compared with the expense of operation of the other plants built 10 years ago. It is planned to operate the plant with 130 men, whereas about 300 men would ordinarily be required to operate one of the older plants of similar capacity.

Charging that Charles Boettcher and Claude K. Boettcher, of Denver, and M. D. Thatcher, Pueblo, and fifteen other manufacturers are in a conspiracy to violate the Sherman anti-trust law, the United States government today filed a dissolution and injunction suit in the United States District Court here, citing the Cement Securities Company and six other cement manufacturing companies as being in the alleged combination in restraint of competition and trade.

Among the defendants named in the suit who live outside of Denver, are: Carl Leonardt, Los Angeles; James Pingree, Ogden, Utah; J. D. Sliemons, Butte; Murrell O. Matthews, Oklahoma City; E. E. Bruse, Omaha, and C. F. Seiboldt, Danbury, Ia.

The cement corporations alleged to be in the combination with the Cement Securities Company, are: The Colorado Portland Cement Company, the Three Forks Portland Cement Company, the United States Portland Cement Company, the Oklahoma Portland Cement Company, the Nebraska Cement Company, and the Union Portland Cement Company.

Five million barrels of cement are manufactured annually by the companies named in the suit, according to the complaint.

Charles Boettcher, it is cited, is president and director of all of the companies named, while Claude K. Boettcher is vice president or director of all the companies. The other defendants named in the complaint are alleged to be directors or officers.

The Cement Securities Company, the complaint alleges, was formed in Denver in 1908. Shortly after, it is charged, it began to acquire and absorb the other

Running Straight and Saving Money

IT IS a well established fact that a conveyor belt that runs perfectly straight will last longer than one that sidles from side to side.

Idler edges will cut through or tear the back of a "crooked" belt and expose the duck to deterioration from moisture.

Here is a Goodrich "LONGLIFE" Conveyor Belt hauling clinker to a bin—*mark how straight it runs.*

No creeping over idler edges. No ripped, torn or worn edges or back. No spillage.

All "LONGLIFE" Belts run straight — they're made that way. A "LONGLIFE" Belt will run in your plant just as straight as this one is doing, and give you the same fine, satisfactory, low-costing service. Try one!

B. F. GOODRICH RUBBER COMPANY, *Akron, Ohio*

Goodrich

"LONGLIFE" *Conveyor Belts*

News of the Concrete Products Factories

The Staton Machine Co., 601 Equity Bldg., Detroit, Mich., have placed on the market a brushing machine that is simple, well built and easily operated and will handle 2,000 blocks a day with ease. It puts the profit right in the block and makes them sell. By brushing away the cement film you can expose the natural beauty of the aggregate giving the block a real architectural and artistic value, allowing you to get a better price for your product.

The Yakima Cement Products Co., Yakima, Wash., recently completed an addition to its plant to accommodate an elevator and bunkers to hold their cement and gravel before it is mixed. They operate electric Anchor tamper and Hobbs block machine. The electric machine furnishes more uniform power and eliminates labor, according to Manager W. P. Hewes. The company has seven steam kilns or curing rooms. They report splendid business and bright prospects in their concrete burial vault department, having three Automatic Sealing Vault Co.'s burial vault molds constantly in operation. The concrete is mixed by a Kent Continuous Concrete Mixer.

Otkon Manufacturing Co., 235 Broad Bldg., New Kensington, Pa., manufacture the Debay block molding machine, which produces 12 concrete blocks per minute (8x8x16) or 720 per hour. The only block machine having stationery core bars and rotating mold members.

Willard O. Kirkpatrick, city building inspector, Flint, Mich., last week called attention to the fact that the ordinance governing the manufacture of cement blocks, used for construction purposes, would be rigidly enforced starting January 1.

He has communicated with Lansing to ascertain whether Flint building blocks may be tested there and says he will soon call a meeting of all the cement block manufacturers serving the city in order that the ordinance might be discussed at length and become well understood. The ordinance deals with the strength of the blocks, the amount of cement used in their manufacture and the placing of the trademark on each block.

The Iron Mountain Cement Products Company, Iron Mountain, Mich., has shipped two carloads of continuous air-space blocks to Ironwood for use in construction of the Peninsula Marble and Granite company's new branch building, 28 by 70 feet. Blocks have also been shipped to Pembine for a public garage, 76 by 50 feet, requiring 250 blocks. They are also being used at Florence, Channing, Iron River, and elsewhere, having become widely known for their up-to-date methods of manufacture by the steam curing process.

The company has also started delivery of cement brick to the new National Bank Building, to be used in backing up the face brick. Face brick is rough texture and four natural colors is also manufactured.

Wm. M. Hood, 126 Atchison Ave., Whiting, Ind., writes:

"I have perfected and am getting ready to market a new system of concrete construction, intended for use in the building of such one story structures as garages, hog or chicken houses and fences. The system consists of the use of pre-cast pilaster and panel units which by reason of their peculair shape and method of assembly are interlocking. While of unit type of construction the structures when completed are in no sense portable and by the use of what I term a slip joint, are not subject to expasion cracks as are buildings of monotholic type of construction. Letters patent have been applied for and as soon as granted I will put the system on the market.

The modern new plant of the Zanesville Cement Products Co., Zanesville, Ohio, is now completed and the company is turning out concrete building units of a standard tested quality and it is their aim to use the most efficient equipment possible and to advertise consistently and maintain a selling organization that will keep their production department going at full speed 12 months of the year. They have installed a Dunn machine for making concrete building wall tile and concrete drain tile and a Hobbs block machine. They also use Dunn sewer pipe molds and a Dunn mixer. Their blocks are faced with marble chips furnished by R. V. Reynolds, Railway Exchange, Chicago.

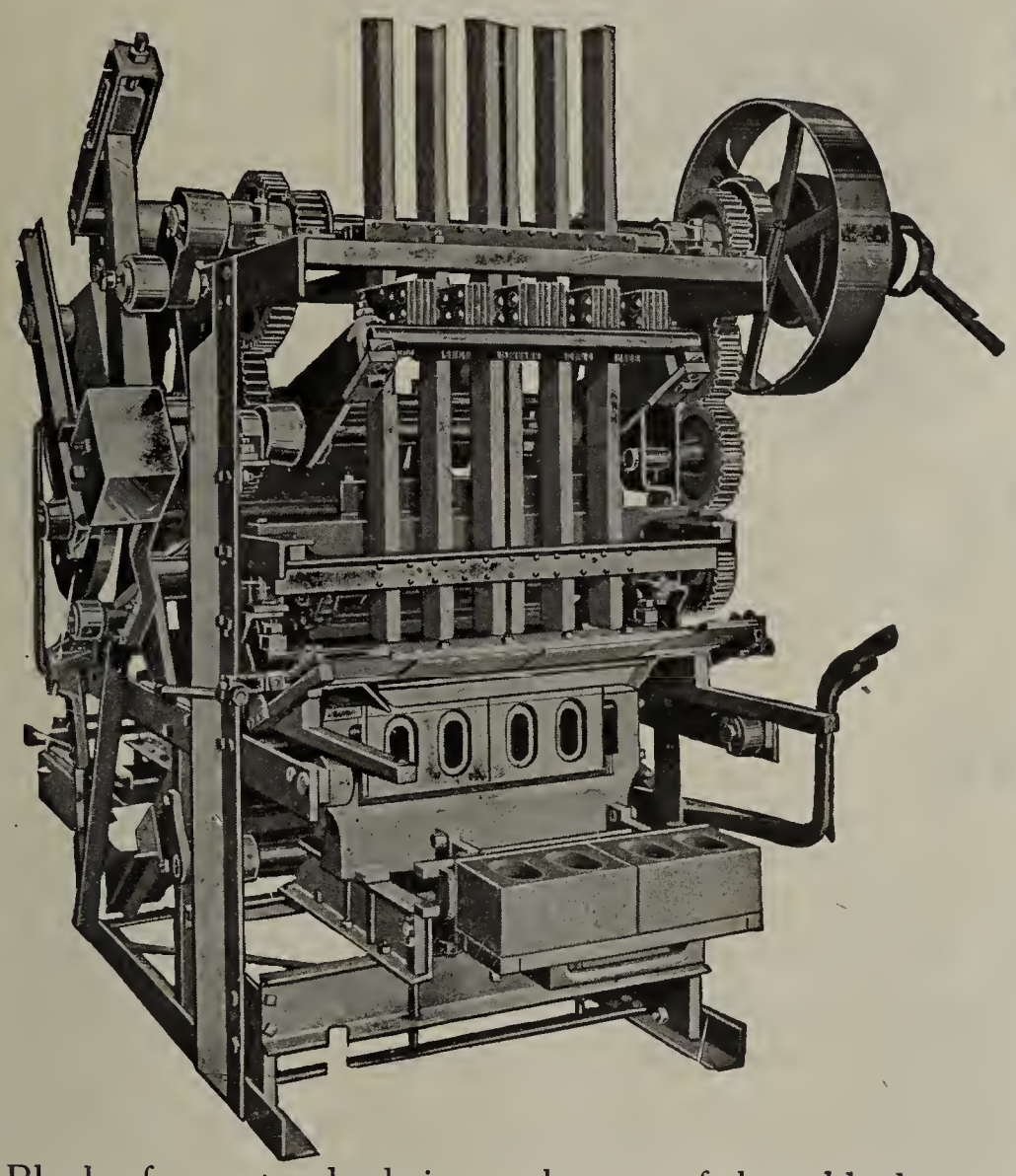
A favorite crusher with concrete product manufacturers is "The Universal" made by the Universal Crusher Co., 230 Bee Ave., Cedar Rapids, Iowa. It seems to be the logical machine to supply the necessary aggregate for the concrete block and tile man. Because of correct design, good materials and superior construction, with extra strength, simplicity and the correct principles upon which it is based, the Universal affords greatest capacity with lowest horse power requirement and minimum maintenance expense. It is built in various sizes to meet every need.

LeRoy Westcott, Hartford, Mich., has purchased of Chas. E. Anderson and Dewey Salnave, the plant of the Hartford Cement Stave Silo Company, and will continue the manufacture of cement stave silos. Mr. Westcott recently purchased of Ned Cook the cement block factory formerly owned by George Kime and will also manufacture cement blocks.

The Winamac Cement Products Co., Winamac, Ind., is erecting a new cement block building adjoining the factory building. In addition to the new office, the company is completing the construction of a storage pit from which the gravel can be elevated to the Dunn tile-making machine with an endless belt. The pit is sunk below the floor level at the factory and arranged so that the wagons or trucks can dump the material quickly into the pit.

The Cement Products Company of Wilmington, N. C., have been awarded a contract by the Atlantic Coast Line for several thousand feet of heavy reinforced concrete railroad culvert pipe, which is now being manufactured at the Wilmington plant. It is of the bell and spigot type and is in accordance with the railroad's specifications. Last fall the Cement Products Company added culvert pipe to their line of concrete products which also include the "SANISEP" septic tanks, agricultural drain tile, and brick.

Besser All Automatic Equipment



Besser Block and Tile Machine
2 in 1

Important Facts

This time tested automatic machine has been in use for years. It will make both block and tile. It will make two different types of tile, all on the same machine. It is not experimental machinery, but tried and proven equipment of known value with years of satisfactory machine service. You can start and make both block and tile with absolute assurance you will not waste time and money in getting started—the **ONLY** COMBINATION BLOCK AND TILE MACHINES.

Products You Can Make

The Combination Machine will make Block of any standard size at the rate of three blocks per minute. It will make tile as follows:

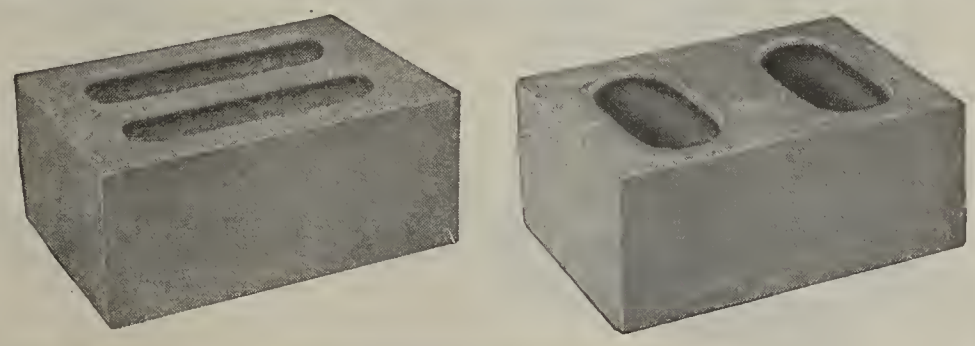
3—5x8x12″ Tile at a time..... 4800 per day
4—5x6x12″ Tile at a time..... 7200 per day
6—5x4x12″ Tile at a time..... 9600 per day

It will also make 5x12x12″ and 5x10x12″ Tile in fractional sizes.

We can furnish machines with 16″ mold to make two 5x8x12″ tile at a time or 24″ mold machine to make three 5x8x12″ tile at a time. These machines are furnished in either hand, semi-automatic or fully automatic types. All Attachments are standardized and interchangeable from hand to automatic power machines, enabling you to increase the capacity by changing attachments from one machine to another without scrapping equipment. These are the advantages of being able to make block and two types of tile on the same machine.

A Besser Combination Block and Tile machine will pay big results. It will enable you to meet the enormous demand for high grade building materials. It gives you the profits from both block and tile and satisfies the demand for both.

Write for full particulars concerning the products and the machines. They are adapted for any purse and any range of production.



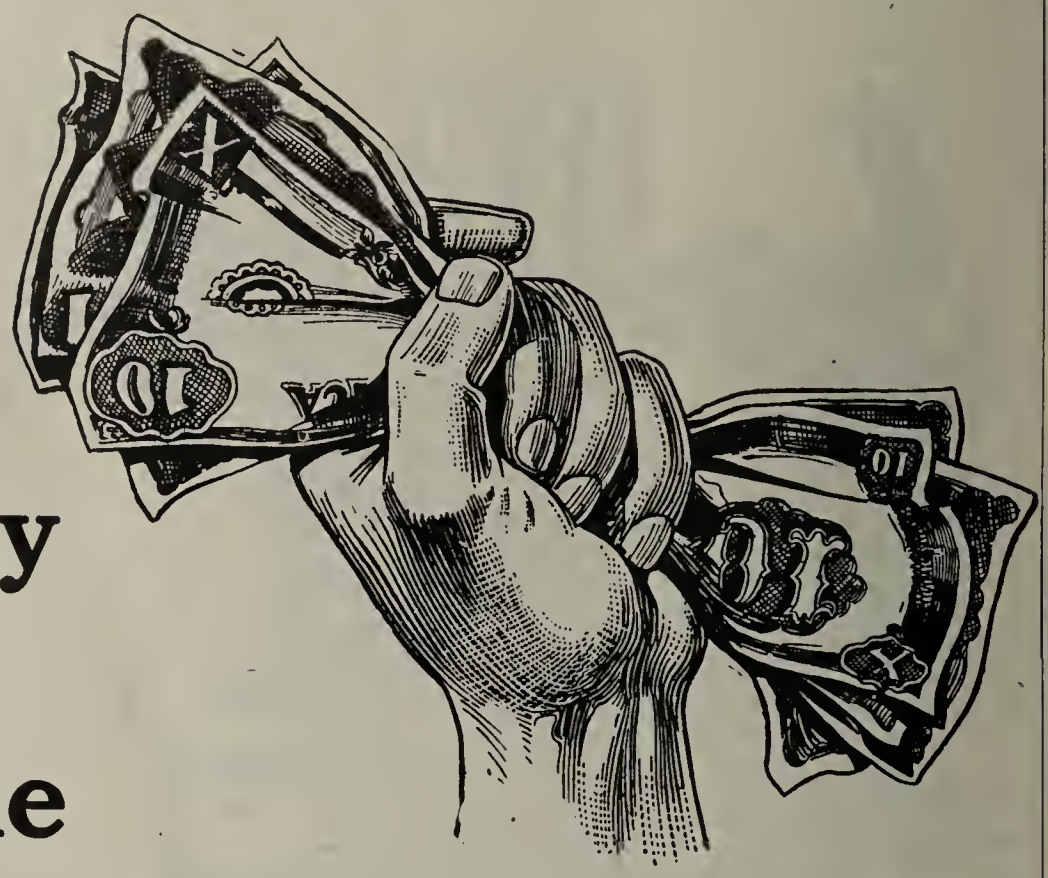
The Besser Sales Co.

547 Monadnock Block
Chicago

YOU CAN MAKE BIGGER PROFITS

AT LAST! AN AUTOMATIC BLOCK MACHINE

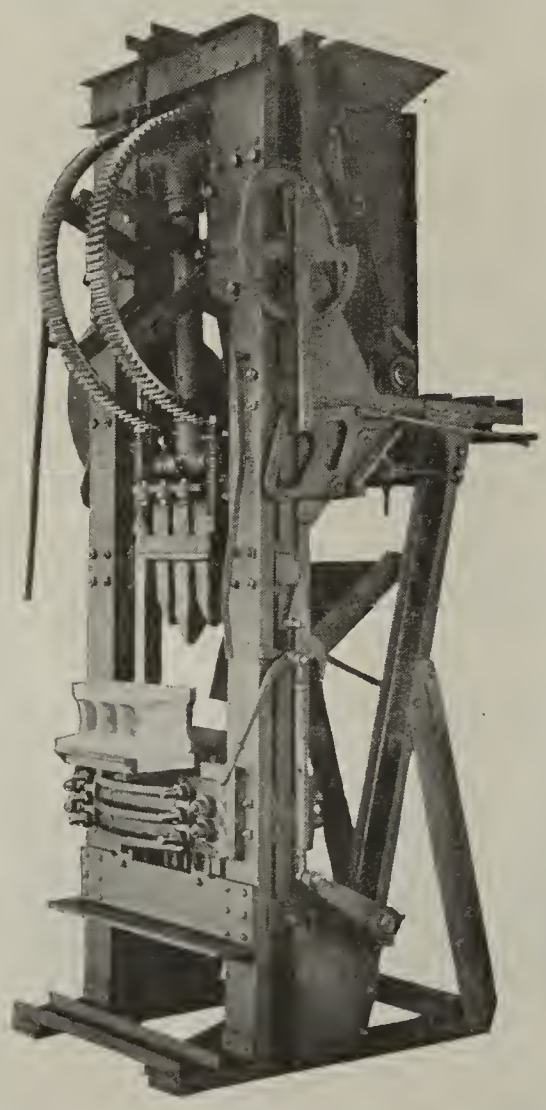
Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block by the



Post Economy Punch Block Machine

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.



This machine is the invention of A. L. Post, the inventor of the Kent Continuous Concrete Mixer, which is well known to concrete products manufacturers. It is the invention of a practical block manufacturer, has been thoroughly tested and has convinced men thoroughly versed in concrete block manufacturing that it produces block that are very dense in structure, free from voids, absolutely square and smooth, and which stands the various building code tests, both as to structure and absorption.

We are now placing on the market the following machines, to be known as the

RED LINE PRODUCTS

Automatic Tampers
Block Machines
Block Cars
Lift Trucks
Gravel Screens
Continuous Mixers
Batch Mixers
Elevating Devices
Electric Motors
Gas Engines

KENT MACHINE CO.
KENT, OHIO

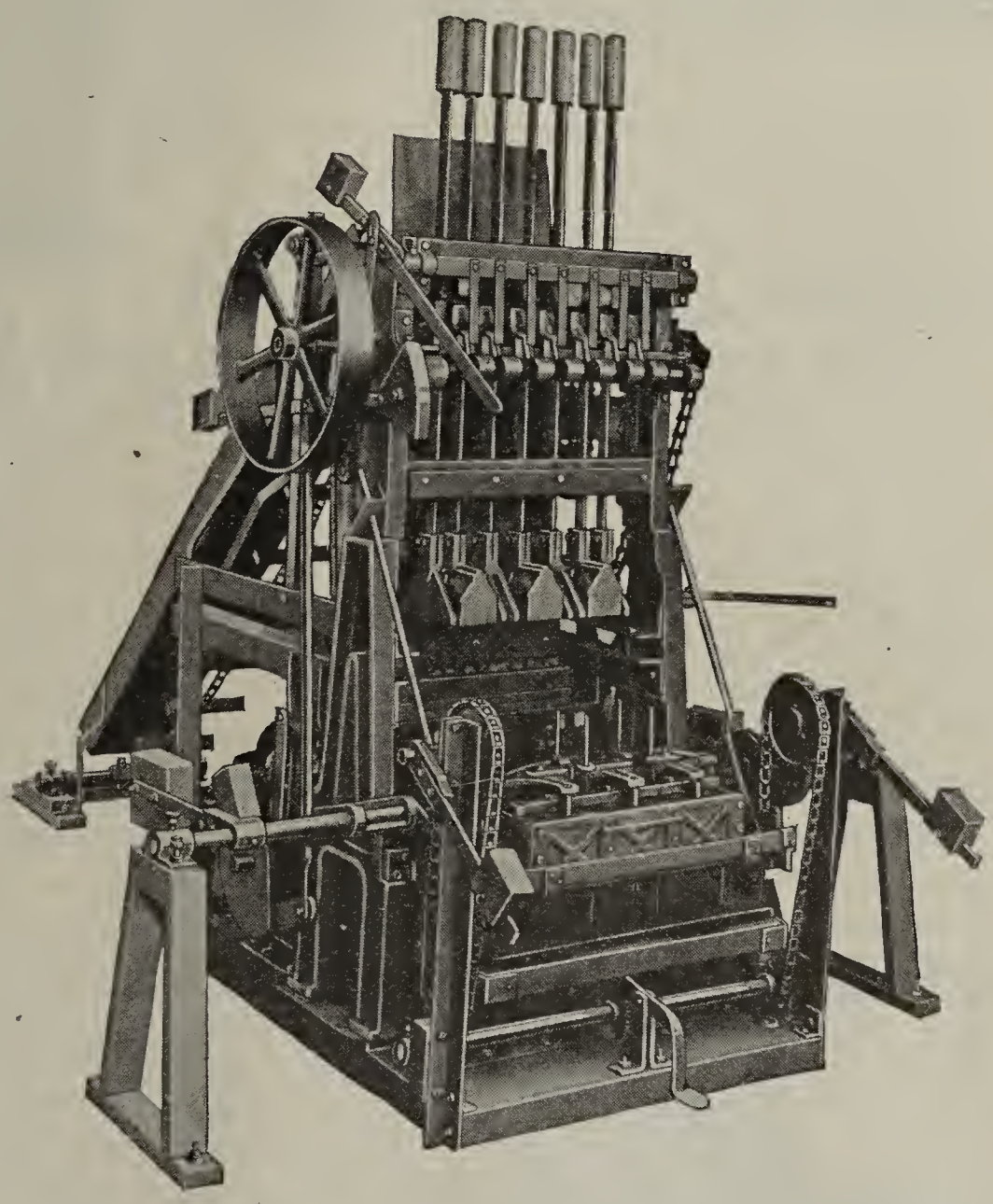
Automatic

through and through—this wonderful new

Ideal

Building Tile Machine

Get this! The machine is rigidly built, all parts in perfect alignment, and is FULLY-AUTOMATIC. Operator merely feeds concrete into the conveyor at the back end, while operator at front end inserts the empty pallets and carries them away filled with tile. The machine is not stopped or delayed while the operators are changing pallets. Just as soon as the tile are discharged onto the wooden pallet, the machine starts on the next set of tile, and the off-bearers carry away the full pallet and put in an empty pallet while the machine is working.



Rate of Speed is Absolutely Fixed

because no time is taken from the operation of the machine for removal of tile, and the insertion of the new pallet. A single cycle of the machine takes 22 seconds and **turns out three tile,** 5x8x12″.

The time-saving, labor-saving, money-making features of this new device commend it to every man interested in the building industry. DROP US A LINE TODAY FOR DETAILS —don't wait till tomorrow.

The Ideal Concrete Machinery Co.

1338 Monmouth St. **Cincinnati, Ohio**

Ideal

Fully-Automatic Building Tile Machine

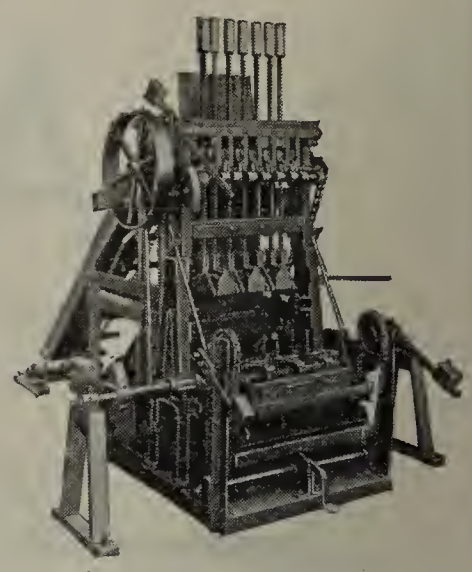
The King Bee of All Automatic Machines

Delivers three standard sized tile on a single wooden pallet, with no stopping or delay for off-bearing of the tile. Minimum attention required and economy prevails along every line. Rate of speed absolutely fixed—22 seconds being required for a single cycle. If different thickness of wall of tile is desired it is only necessary to change the three stripping pallets and cores.

Write today for all the facts of this wonderful new FULLY-AUTOMATIC machine

The Ideal Concrete Machinery Co.

1338 Monmouth St. Cincinnati, O.



A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.

216 E. River St. PERU, IND.

It Pays to Make Medusa Concrete Blocks

Concrete building blocks made with Medusa Waterproofed Portland Cement are absolutely impervious to moisture. The additional cost is but a fraction of a cent per block.

For courses above grade, the block can be faced with Medusa Stainless White Cement, giving the appearance of hand-cut stone, at another very small cost.

Build yourself the name of producing "quality block" and you'll build a big, steady, extra-profitable business along with it. Medusa Cements (White and Gray) and Medusa Waterproofing are the combination that will help you.

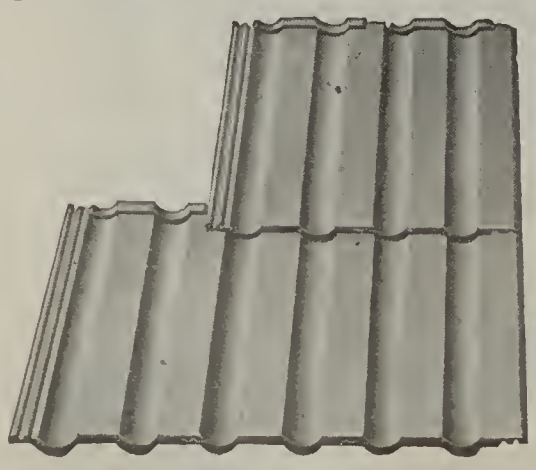
Write today for the Medusa Literature

THE SANDUSKY CEMENT COMPANY

Department E Cleveland, Ohio

MEDUSA Stainless White Cement

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

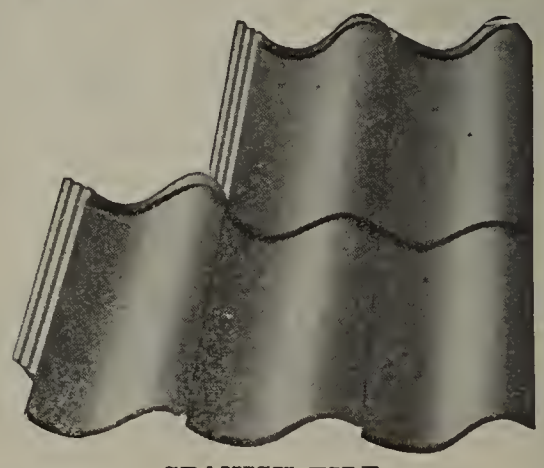
Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name: "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.



SPANISH TILE

MAKE EVERY ROOFING JOB A BUSINESS GETTER

That means every customer, an enthusiastic booster—every roof you lay, an effective salesmen.

Concrete roofing tile made on an All Automatic Roofing Tile Machine are best advertised by their owners. That's why many builders now use and recommend them exclusively. They know the business such advertising creates.

Concrete roofing tile made on our machines offer a complete roofing service. They are used on the mansion and the cottage—for the barn and the hen house.

All Automatic Concrete Roofing Tile, for sheer architectural beauty, are unsurpassed. They are furnished in two colors—rich warm red and cool sage green.

The All Automatic Hand Machines will produce all the required straight and special pieces for any roof. They require no skilled labor and manufacture 900 straight tile or 300 finishing tile a day. Easy and rapid in operation and the only machines which produce a line of tile where joints can be broken.

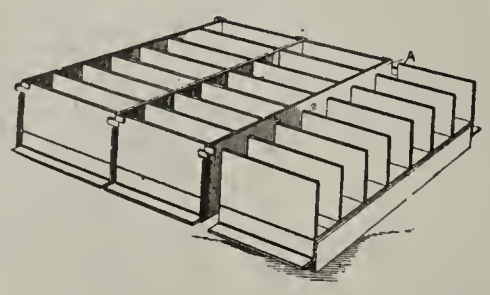
The popularity of roofing tile is constantly growing. Get in on the building boom with a quality popular product for new and re-roofing work.

Complete plants consisting of forms, machines, pallets and moulds, $1,200.00. We help you get started.

ALL AUTOMATIC MACHINE COMPANY

1740 EAST 12TH ST. **Suite 590** **CLEVELAND, OHIO**

MOULDS FOR POURED CONCRETE BRICK AND BLOCKS



Our brick molds are adapted for making both common and faced brick. Pallets are not used as the bricks are discharged from the molds, directly into the pile.

Our DOLLAR block mold is the only mold made, for poured block, that can be filled twice every day.

Write for circulars

MERRILL MOORE
Box 33, Creston, Iowa

REICHERT Adjustable Steel Molds

Improved locking device, saves time. Tight, accurate fit at joints produce smooth finish.

They help you land contracts
You can bid lower, at no loss of profit. Reichert Forms are standardized—units interchangeable. Ask for catalog.

Reichert Metal Concrete Forms Company
1188 Weil Street Milwaukee, Wis.

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16″ blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16″ back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

The Choice of the Well Informed

"THE PRESS THAT MAKES THE MONEY"

We claim—and conservatively—that the Helm brick and block press has embodied in its design and construction more real points of superiority than any other brick or block machine made!

Some of the outstanding features are: Speedy action, interchangeable parts, simple in design and construction, 40 tons pressure on the medium wet concrete, your production is unlimited, etc., etc.

To fully explain these and many other points of superiority—may we send you a catalog?

THE HELM BRICK MACHINE CO.

862 MITCHELL ST. CADILLAC, MICH.

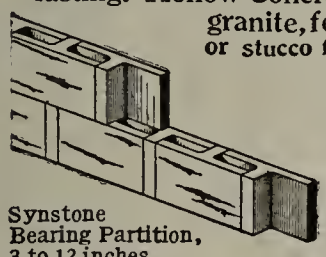
SYNSTONE PRODUCTS

This 8" WALL used exclusively in rebuilding Halifax. Also Minnesota Steel Co's Model City.

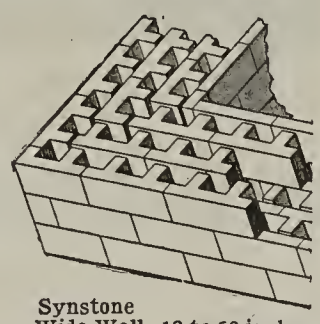
The Last Word in CONCRETE Construction

Costs Less Than Any Other Practical Wall Construction

Wet process, making real Concrete walls, impervious to heat, cold and moisture, fireproof and everlasting. Hollow Concrete Walls, stronger than brick, faced with beautiful natural material—crushed granite, feldspar, marble or sandstone, with all the sparkle and life of natural stone. Brick or stucco facings if desired. A wet, soggy mixture, 1 cement, 2½ sand and small gravel, 4 parts or 1" stone or gravel, producing stone withstanding 3000 lbs. pressure per sq. inch and 1700 degrees heat for one hour without injury. Complete machinery making all walls and all shapes and sizes of blocks required for them, by simply hooking on another core. Every block perfect with true edges. Unskilled labor. one, two or three men, capacity 50 blocks or 100 sq. feet per hour.

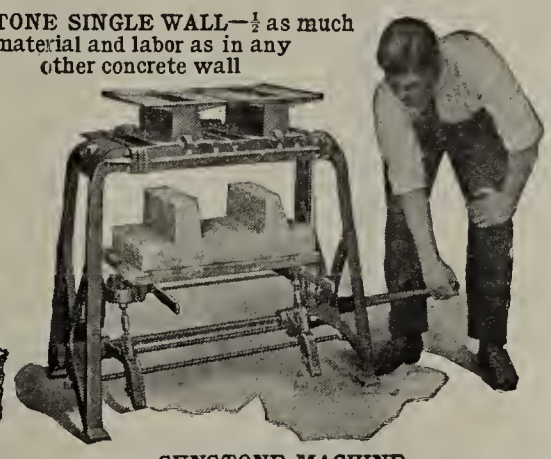


Synstone Bearing Partition, 3 to 12 inches



Synstone Wide Wall, 19 to 60 inches

SYNSTONE SINGLE WALL—½ as much material and labor as in any other concrete wall



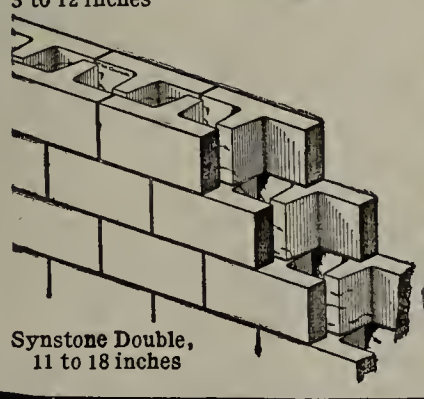
SYNSTONE MACHINE

Send for catalog.

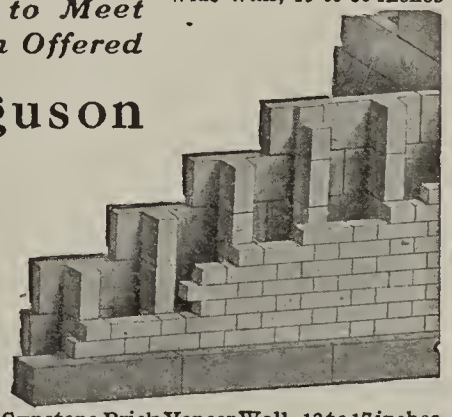
Equip Yourself to Meet any Competition Offered

The Ferguson Synstone Company

803
17th St., Denver,
Colorado, U.S.A.



Synstone Double, 11 to 18 inches



Synstone Brick Veneer Wall, 13 to 17 inches

Illustration S-1086. *Saucrman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

Sauerman Bros., 1139 Monadnock Bldg., Chicago

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

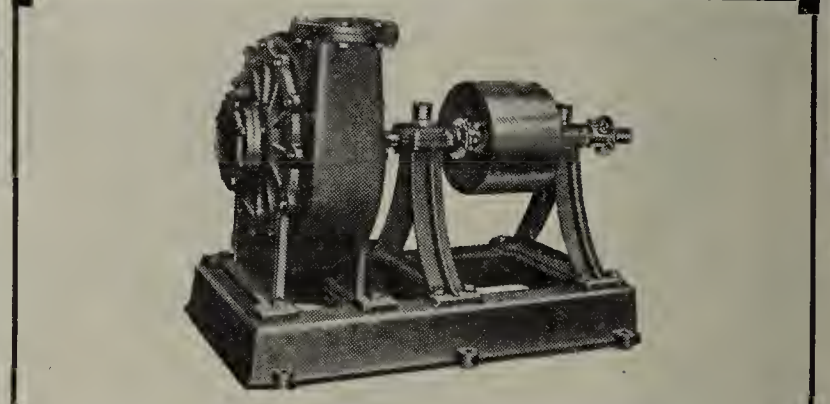
POWER DRAG SCRAPER

The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN
907 Lumber Exchange Bldg. Chicago



THE LIGHTNING SAND, GRAVEL AND DREDGING PUMP

Never Loafs!

The sand company or contractor who has used the Lightning Sand Pump longest, appreciates it most.

It has demonstrated its value and sure satisfaction in thousands of cases throughout the country.

It never loafs on the job, and its life is one long, unbroken streak of production.

Simple in design and construction—drum removable and adjustable to any position; drum sides quickly removable; Ball thrust bearings; front and rear. Shell and runner made of semi steel.

Write today for full information.

Kansas City Hay Press & Tractor Co.
Kansas City, Mo.

Cement and Engineering News

Vol. 34 Chicago, May, 1922 No. 5

Excessive Special Tax

No country can live and grow without information highways. In many ways it is more important to provide the means for the dissemination of intelligence than for the transportation of material commodities.

For this reason the government has always recognized the necessity for low postal rates on newspapers and periodicals. During the war, however, the publications of the country were loaded with increases on the carrying charges in the mails. These increases were provided for in the Revenue Bill of 1917 and now amount to four times the pre-war charges.

While paying this excessive special tax, the publishers have been paying all other taxes of what ever kind, levied upon industry as a whole, and have had to stand and are still suffering under high costs for labor, paper, and other essentials.

It is significant too, that this special tax on the circulation of publications, is a tax on a PROCESS of the industry. It is a recognized principle of taxation that taxes should be levied on the products of industry and not on the processes. Publishers have been paying on both processes and products.

The case is not dissimilar to taxation of traveling salesmen of labor-saving machinery. Indeed the advertising pages of publications may be likened to traveling salesmen. How foolish and futile to make it difficult to get the orders which are the life blood of industry.

Every interchange of commodities must be preceded by an interchange of ideas, of information, of proposals and acceptances, and this important function of our publications needs support and encouragement at this time to build up and restore national prosperity.

We would abhor the idea of taxing schools, yet but 7 per cent of our boys and girls go beyond the grammar grades. The rest of their education must come from reading, and yet the present law is in effect a tax on this source of education which is depended upon by 93 per cent of the people to take the place of higher education.

As a result of these exorbitant postal changes, publishers have had to increase subscription rates greatly, or have ceased soliciting subscriptions from sections of the country where the high postal rates would make it unprofitable. In still other cases publishers have tried to absorb the additional costs and numbers of them have fallen by the wayside in the attempt.

In 1918, the Federal government collected from the publishers $11,712,068.18, and in the last fiscal year this had grown to $25,496,719.94. During the current year it is estimated that the publishers will pay to the government for carrying their papers the huge sum of $33,000,000.

This too, notwithstanding the fact that the high rates have forced out of the mails an enormous tonnage of newspapers and magazines which now go by express, baggage, motor truck, freight or by water for less than Uncle Sam will carry them.

Unfortunately some of the most necessary publications cannot be shipped in bulk lots and cannot escape the back-breaking postal charges. Among this class of papers are the business and technical papers going to retailers, factories, and professional men; the farm papers which are raising the standards of agriculture; the religious papers which promote the spiritual life of the country; the fraternal publications which bind together groups of men and women for their common good; the educational papers which carry the light of new knowledge into the humblest homes, and many others of similar kind.

The burden falls heaviest upon the smaller papers of the country. The big papers with a million or more of readers can afford to develop their own systems of transportation. It falls heavily, too, upon the readers who most need the enlightening force of good reading.

In spite of all this the publishers are most modest and moderate in their appeal. All that is asked is the repeal of the last two increases, those which went into effect in 1920 and 1921, retaining the rates in effect just prior to these increases.

This will not affect the zone system in the least, neither will it affect the present free-in-country privilege enjoyed by the smaller weeklies and dailies.

The rates asked for in the bill now proposed in Congress, would still give the government approximately *175 per cent more than the pre-war rates,* and would not relieve the publishing industry of one cent of the other Federal Taxes now paid by other industries.

Here is another very important consideration—the special or super-taxes which the War Revenue bill imposed upon some ten other industries have either been taken off or materially reduced. Is it fair that the publishing industry, of all industries, should be singled out as the sole exception and compelled to stagger along under special war taxes to defray war expenses?

This seems all the more unfair, when it is remembered that the newspapers and periodicals of the country did not go over the top for pay, during the war; that they did not profiteer; that they were in no sense a war industry. On the contrary they volunteered space and services to the value of millions of dollars.

In a word what the publishers are asking, would amount in dollars and cents to a gross reduction in rates of about $8,000,000 as against total post office receipts of about $500,000,000.

Furthermore, the effect of lowering the rates would attract back into the mails enough tonnage to largely compensate for the apparent or bookkeeping loss.

Investors Find Safety in Manufacturing Plants

Owners of securities of well managed manufacturing companies have reason to congratulate themselves as they read the newspapers these days. The daily press is full of stock fraud cases in which unwary investors and greedy seekers after big returns have been stung by wild-cat companies, fake brokers and bucket shops.

The "Ponzi" business is easy for the crop of dupes seems limitless. The so-called "buyers' strike" we have heard so much about, apparently was never extended to wild-cat stocks and get-rich-quick schemes. Puck was right when he said in one of Shakespeare's plays, "What fools these mortals be," and Barnum was not far wrong either when he estimated the birth rate of suckers to be one a minute.

The investor in manufacturing plants, therefore, can pat himself on the back. He may be drawing only a comparatively modest rate of interest on his investment, without the thrill of maybe, some time, doubling his money by reason of an oil gusher, but he can take comfort in the thought that he has his dollars in the safest business in the country, aside from the engraving plant which prints government bonds.

Business Hunting

U. S. Buying Power Analyzed by Counties by Advertising Agency

One of the most definite needs which has been felt at the result of intensified selling methods has been the need for more specific, localized information about markets and potential customers.

Now an advertising agency comes forward with this information, as a help to its clients. Instead of the state or the large city, this organization has taken the county as the unit of study. Every county in the United States—3,048 of them in all—has been analyzed as to business possibilities. As a guide in determining the wealth, prosperity, and buying power of these communities, the following figures have been obtained for each county:

Value of farm property
Value of crops
Amounts of income tax
Value of manufactured products
Total motor car registrations
White population
Total mileage of all roads
Total mileage of surfaced roads

For further convenience, the information is recapitulated by states, and a climatology record is included, based on averages for periods of 26 to 50 years.

The task of compiling this data was carried through by the Research Department of the Wm. H. Rankin Company. In order to secure the desired information, this organization went to every Department in Washington, D. C., the statistical department of every state, and many university and private research institutions.

Such an undertaking as this indicates the science which business-hunting has become in 1922. The element of guesswork is practically eliminated from the decisions of salesmanagers who have their territory dissected for them with such completeness.

Advertisers who have received this data were unanimous in their immediate recognition of its value.

Awarded Wason Medal in Recognition of Research on Moments and Stresses

Prof. H. M. Westergaard of the department of theoretical and applied mechanics, University of Illinois, Champaign, Ill., was awarded the Wason medal of the American Concrete Institute at its meeting at Cleveland in recognition of his paper on "Moments and Stresses in Slabs."

The flat slab is the technical name for the type of floor construction now used in reinforced concrete buildings. Professor Westergaard's paper was a mathematical and analytical discussion of the method of calculating the strength and proportioning the parts of these slabs.

Tests, both at the University of Illinois and at other institutions, were the basis of Professor Westergaard's analysis. The paper has been commented on as follows:

"There has been a wide difference of opinion about this type of construction; the paper of Professor Westergaard is a comprehensive and convincing treatment, and being correlated with the existing test data it has been adjudged to be an important contribution to the literature of building construction."

It is of interest that of the six men who have received the Wason medal, four were at the University of Illinois at the time of the award. Besides Professor Westergaard they were W. A. Slater, now at the Bureau of Standards in Washington, D. C., A. Abrams, now a member of the faculty at Lewis institute in Chicago, and A. B. McDaniels, at present a civilian employee of the War Department.

Cleveland Wire Cloth

"Cleveland" Double Crimp Wire Cloth is so constructed as to insure positive uniformity of product. The crimping of both warp and woof wires at every point of contact entirely does away with the possibility of slippage even under the most severe conditions. Hence the openings must remain of uniform area during the life of the screen. And the life of "Cleveland" screen is far longer than that of ordinary screens, due to the rigidity imparted by double crimp construction and the use of superior wire. The product of the Cleveland Wire Cloth and Mfg. Co., 3579 East 78th street, Cleveland, Ohio, is so satisfactory that the initial order invariably makes a permanent customer for them.

Business is good with the Cleveland Wire Cloth & Mfg. Co. They have doubled the capacity of their plant during the past year and will soon have to double it again to keep up with the demand for their product. Four aims have guided them in the development of their business. First, to manufacture wire cloth of a standard tested quality. Second, to keep production a step ahead of demand. Third, to use the most efficient equipment possible. Fourth, to advertise consistently and maintain a selling organization that will keep their production department going at full speed 12 months of the year.

Opening Statement for Defendants in the Trial of Cement Manufacturers for Alleged Violations of the Sherman Act

HENRY M. STIMSON, *attorney for the Defendants, in opening the trial now being conducted before Judge Knox in the Federal Court, for violations of the Sherman Anti-Trust Laws, said in part*:

The defendants deny absolutely the charges of the indictment, that there was any suppression of competition among them or any agreement to suppress it. We will go much further than a mere denial. We propose to lay the facts of this industry before you to let you see the way in which these manufacturers carried on their business, become familiar with the operation of their minds, and see that this has not been a criminal business and that their minds have not contained any criminal purposes.

There are four cardinal points which we propose to make in our evidence and which I hope the jury will carry in their minds as the case unfolds.

First, that at all times there has been constant, keen competition between these defendants. We shall show you that investigators of the Government itself have spoken of this industry as "the most individualistic of the larger branches of manufacture" and have spoken of the competition between the various cement manufacturers as "bordering on the cut-throat variety."

Second, that their profits have been extremely low —on an average, according to the Government's own statistics, hardly more than half the average of all the other manufacturing corporations of the United States. In 1919, these men earned on the average of their invested capital a return of only seven per cent. and in 1920 a return of only five per cent.

Nineteen-twenty was the period of the highest prices obtaining in this and the other industries of the United States, and the rate of return which these cement manufacturers then obtained on their capital was just one-third of the rate which the four Circuit Judges of this District have declared in a decision to be a fair and proper return on the invested capital of a manufacturing industry.

Third, that during the great period of war and post-war inflation, when the prices of all commodities of this country rose tremendously owing to the depreciation of our money standard, the manufacturers' price of cement rose less than almost any other commodity, and far less than the average. For example, the price of cement rose far less than the price of coal, which is one of the most important ingredients entering into the production of cement.

We shall show you that in the spring of 1919, at the request of the Government and in order to give industry a chance to recover itself, these manufacturers voluntarily reduced the price of their product 15 cents a barrel.

Fourth, we shall show you that the two associations to which these manufacturers belonged, instead of being devised as instruments to suppress competition, have been used to make competition broader and more intelligent; that the only purpose of their existence has been to spread the use of cement, in which they have been extremely successful, and, by furnishing to the various manufacturers statistics of production, stocks, shipments and accurate knowledge of the amounts of cement called for by outstanding contracts, to enable them to carry out their competition far-sightedly and with a view to its permanence. The surest road to monopoly lies through the ignorant, cut-throat competition which enables one manufacturer to bankrupt and absorb another through the latter's ignorance of necessary conditions.

We will show you that the work of these associations was directly in line with recommendations which were being made publicly throughout the United States by the Federal Trade Commission at the time, and we shall also show you that the Chairman of the Federal Trade Commission personally addressed the Portland Cement Association and commended its activities, and we shall show you further that every step proposed to be taken by the other association, the Cement Protective Association, was communicated to the Federal Trade Commission and stenographic minutes of all its meetings were filed with that Commission, together with copies of its statistics.

The Government proposes to offer evidence that the quoted prices of cement coming from these different manufacturers have been similar or identical at given times in the same market, and have continued so for long periods of time. No one disputes that. No other condition would be possible in the case of a standardized produce like cement and under such keen competition as exists in the cement industry.

We will show you that in the case of cement, as with many other standardized products, similarity of price is a necessary result, not of combination, but of competition.

We shall show you that Portland cement has within the past seven or eight years been completely standardized so that there is practically no difference between the various brands of the different manufacturers. Each brand contains the same material as every other brand. These standards have been set up, not by the manufacturers themselves, but by the United States Government, the American Society of Civil Engineers and the American Society for Testing Materials.

It is a movement which has for its purpose to promote the public safety by creating uniformity of strength in a material which enters into every construction. From this condition it necessarily follows that at any given time in a free market all of the different brands will command the same price.

No buyer will pay more for one article when he can get a precisely similar article for less, and the minute one manufacturer lowers his price, provided his capacity is sufficient to affect the market, all others must at once follow or they will get no business.

We shall show you that this uniformity of market price at any given time in a given market is a common characteristic of many other standardized commodities where keen competition between manufacturers is keen, such, for example, as salt, wire nails, wood screws, anthracite coal in steam sizes, crude oil and gasoline, sulphur and many drugs and chemicals.

Everyone knows how the standard size loaf of

bread brings everywhere at the same time the same price and yet no one would think that all bakers in the United States were organized into a trust.

Furthermore, we shall show you that cement is such a common and widely distributed product and these Eastern manufacturers, who are the defendants here, are, compared with some other industries, so small in capitalization that the distribution of their product is necessarily made mainly through dealers.

To distribute it themselves direct to the consumer would involve an investment of capital in warehouses, trucks, etc., all over the country which would be prohibitory. More than sixty per cent. of the cement produced goes into the small lots which the dealer peddles out to retail customers, and in addition to that he controls the sale of 20 to 25 per cent. more of the product which goes to larger consumers. As a result, the market of these defendant manufacturers is necessarily a dealer market. They are largely at the mercy of the dealer for the distribution of their goods, and everyone knows that a dealer market tends to be a one-price market.

A manufacturer who tries to give more favorable terms to one dealer than he does to another very promptly gets into trouble. We shall show you that some of these companies send out their quotations to as many as 5,000 dealers scattered throughout New England and the Middle States.

Any change of mill price to one of these dealers means a corresponding change to all, for the change will be known at once, and any change on the part of a competitor, provided the competitor is not one of the smallest of the defendants, must be watched for and followed.

From these two general characteristics—the standardized commodity and the dealer market—necessarily results substantial uniformity in the market price, just as in any given day on the Stock Exchange the market price of a standard security like Liberty Bonds is uniform.

We shall show you that the market price of cement remained substantially uniform, even when every manufacturer was selling below cost, during one of the bitterest cut-throat wars in the history of the industry, and we shall show you that practically the only time when it was not substantially uniform was during the brief period in 1920, when, owing to railroad strikes and coal shortages, there was for a brief period a great demand for cement, which even the utmost efforts of these manufacturers could not supply, and prices were at their peak.

But underneath this substantial uniformity of market price, we shall show you these 19 defendants competing with the utmost intensity, struggling constantly to get away business from each other, employing large forces of salesmen, carrying on expensive advertising, to show the reliability of their respective brands and the excellence of their service, and striving in every honest way to build up their business at the expense of their competitors.

We shall show you that this competition served to keep the market price of cement so low that many cement companies, including some of these very defendants, have been through periods of failure and bankruptcy and the average rate of their return upon the amount of their invested capital during the time complained of in the indictment has been far below the average received by other manufacturing industries throughout the United States, and less than one-third of the amount fixed by our courts as a legitimate rate of return.

Reducing Blasting Costs

Reports from various parts of the country show that "Dumorite," the new explosive recently put on the market, is effecting reductions in blasting costs amounting to one-third or more. Statements from users show this is especially true in quarry, farm blasting and other open work, because the new dynamite frequently shoots stick for stick with regular forty per cent dynamite while at the same time, each case contains at least one-third more cartridges.

A quarry company in the Middle West reports that in their operations, Dumorite is materially reducing blasting costs. In eastern quarries, equally good results have been obtained.

Experimental work in stump blasting had already shown that Dumorite was an important money-saver for the farmer. A blaster of Worsham, Virginia, is using it and reports:

"I want to advise that I find it as good stick for stick as any forty per cent dynamite I have ever used and as it has thirty-three per cent more sticks per case than any forty per cent dynamite I have ever used, it cut the cost of blasting out stumps just thirty-three per cent. Besides there was no headache caused from using it and this feature alone appeals to the farmer."

In states where large stumping operations are under way, experience is also showing that the new explosive is a great boon to farmers, since it enables them to make an important slash in blasting costs.

These reports follow out the statements made concerning the explosive at the time it was perfected. The Du Pont Company then announced that "Dumorite" was manufactured on a double base of modified nitroglycerin and guncotton, that it could not freeze and would not produce headache. This last advantage, combined with the saving in blasting costs, is causing it to be regarded as the most advantageous explosive on the market at this time.

A New Book on "Concrete Stone Manufacture

In 1915 Mr. Harvey Whipple, managing editor of Concrete, New Telegraph Bldg, Detroit, Mich., published a valuable treatise on "Concrete Stone Manufacture." At that time it was the first and only volume that had appeared on the subject and was read with eagerness by those who wished to inform themselves upon a subject that was destined to become a factor in the building industrial world.

Since 1915 this author has gathered much new data, made possible from practical experience and the development of the industry. The book, therefore, has just been completely revised and considerably enlarged and the new edition is just being put on the market.

The new volume covers more than 300 pages, with nearly 200 illustrations, and supplies as near a complete education on this kind of work as one can possibly get from a book. It includes chapters on the selection and combination of materials; the layout and equipment of plants; moulding and curing; surface treatment; shop records and cost keeping, and closes with some very pertinent suggestions on business methods and plans for selling the product.

The author has set out with a determination to give real value to his readers and has succeeded remarkably well. The book is bound in blue cloth and sells at only $1.50. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, 22 Quincy St., Chicago, Ill.

The Electrical Operation of the River Rock Gravel Company

By A. V. Thompson

This article describes the most modern and best equipped plant of its kind in the West. As electricity is used exclusively in all operations, the author presents such information as will interest those who operate similar plants in whole or in part by power other than electricity. The article contains a complete description of the electrified method employed in excavating the material, transporting it, and preparing the finished product.—Editor.

The plant of the River Rock Gravel Company is located on Tesla Creek seven miles south of Tracy in central California, where the river channel breaks from the Coast Range and spreads into the west rim of the San Joaquin Valley.

This creek or arroyo is a natural drainage channel where rains are infrequent. The gravel deposits extend fifteen miles up the channel from the washing plant into the Coast Range. When heavy rains come, generally during January, February, and March, floods rush down this arroyo carrying thousands of tons of sand, gravel, and boulders which tend to replenish the materials that have been excavated during the preceding dry period. Such heavy downpours may not come more frequently than once every third or fourth season; and it is not infrequent to have periods of drought of seven or eight months' duration, which affords opportunity for the removal of sand and gravel from the stream bed without interruption by high water.

The quality of sand and gravel for construction work is determined by freedom from solubles and also by the degree of irregularity of contour of the particles, sharp edges being desirable. The solubles are eliminated by thoroughly washing the sand and gravel at the washing plant. As the geological formation in this locality is of recent origin, the second qualification is supplied by nature, the small rocks having sharp edges in distinction to the smooth and well rounded surfaces of rocks which have been subject to a longer period of water wear.

The material as taken from the creek or arroyo is colloquially known as "dirt" or "bar run" and in various parts of the channel varies in compactness and in the proportions of sand, gravel, and boulders.

Process.

The dirt is dislodged from the creek bed by a Monighan electric drag-line excavator. From the bucket of this excavating machine the material is loaded into a "grizzly" car, the large boulders being eliminated in the process of loading. This car is hauled by an electric locomotive over a standard-gauge railroad to the dumping pit at the washing plant. From the dumping pit the material is fed onto a belt-line conveyor which carries it to the highest point in the washing plant. Upon dropping from the belt-line conveyor, it is classified as follows:

Large material for gyratory crusher (3-in. grizzly).
Medium size for disc crusher (1⅝-in. conical screen).
Balance of material for conical screens and classification in storage bins.

The crushed materials from the gyratory and Symons disc crushers are fed onto separate belt-line conveyors to independent Link-Belt conical screens. This conveyor system is so arranged that materials from any of the bins in the main washing plant may be fed onto the belt for mixing purposes from the bottom or ground level of each bin. The mixed material, or crushed rock, can then be discharged directly into bins for loading on cars for storage or shipment; or the crushed rock may be fed back onto the main belt-line conveyor for processing and to the appropriate bin in the main washing plant.

The assortment of finished materials is as follows, being determined by the perforations in the conical screens:

(1) Gravel 1 to 1½ in.
(2) Gravel ¼ to 1 in.
(3) Gravel ¼ to ½ in.
(4) Sand to ¼ in.
(5) Crushed rock ¼ to ⅝ in.
(6) Crushed rock ⅝ to 1¼ in.
(7) Crushed rock 1¼ to 1¾ in.
(8) Cementing road gravel.

The mesh of the first conical screen is 1⅝ in. Everything between 3 in. and about 1½ in. goes into a bin to be fed into disc crushers. The material from the crushers is fed back onto the main belt if larger than 1¾ in. and into bins if smaller. Water spray plays on each conical screen and not only washes the material but assists in moving it to the next revolving screen.

All materials from the washing plant are loaded into standard gondola cars for shipment or for storage. These cars are moved by an electrically operated Orton Steinbrenner locomotive crane to the main-line track for shipment or to the storage piles where they are unloaded by the crane. The crane also serves to load cars from the storage piles for shipment.

Electrification of Haulage System and Crane.

With the increasing price of fuel oil and the statements of the best authorities that no great reduction in price could be looked for, the fact that electric power was giving uniform satisfactory results on the main drives of the washing plant and that power was available, led to the electrification of the locomotive and crane which makes this a 100 per cent electric plant. Under steam operation considerable trouble had been experienced from shut-downs and expensive repairs had been caused by bad boiler water and the scarcity of skilled labor during the war period.

General Scheme of Power Distribution.

Three-phase, 60-cycle, 17,000-volt power is purchased from the Sierra and San Francisco Power Co. A bank of three single-phase transformers steps down the incoming voltage to 2300. At this distributing voltage, lines run to a portable bank of transformers on a truck which serves 440-volt power to the drag-line excavator that at some future time may operate as far as one mile from the washing plant. The lime from the portable transformer bank to the drag-line excavator is carried in a flexible water-proof armored cable. The electric shovel has a bank of 2300/400-volt transformers as a part of its equipment. Three-phase power at 2300 volts is also supplied to the motor-generator station for providing direct-current power at 600 volts to the third-rail haulage system.

Third-rail System.

Every known system of haulage was carefully studied and the 600-volt direct-current third-rail contact system was adopted as being the best suited to meet the local conditions.

The first condition prescribed by the plant opera-

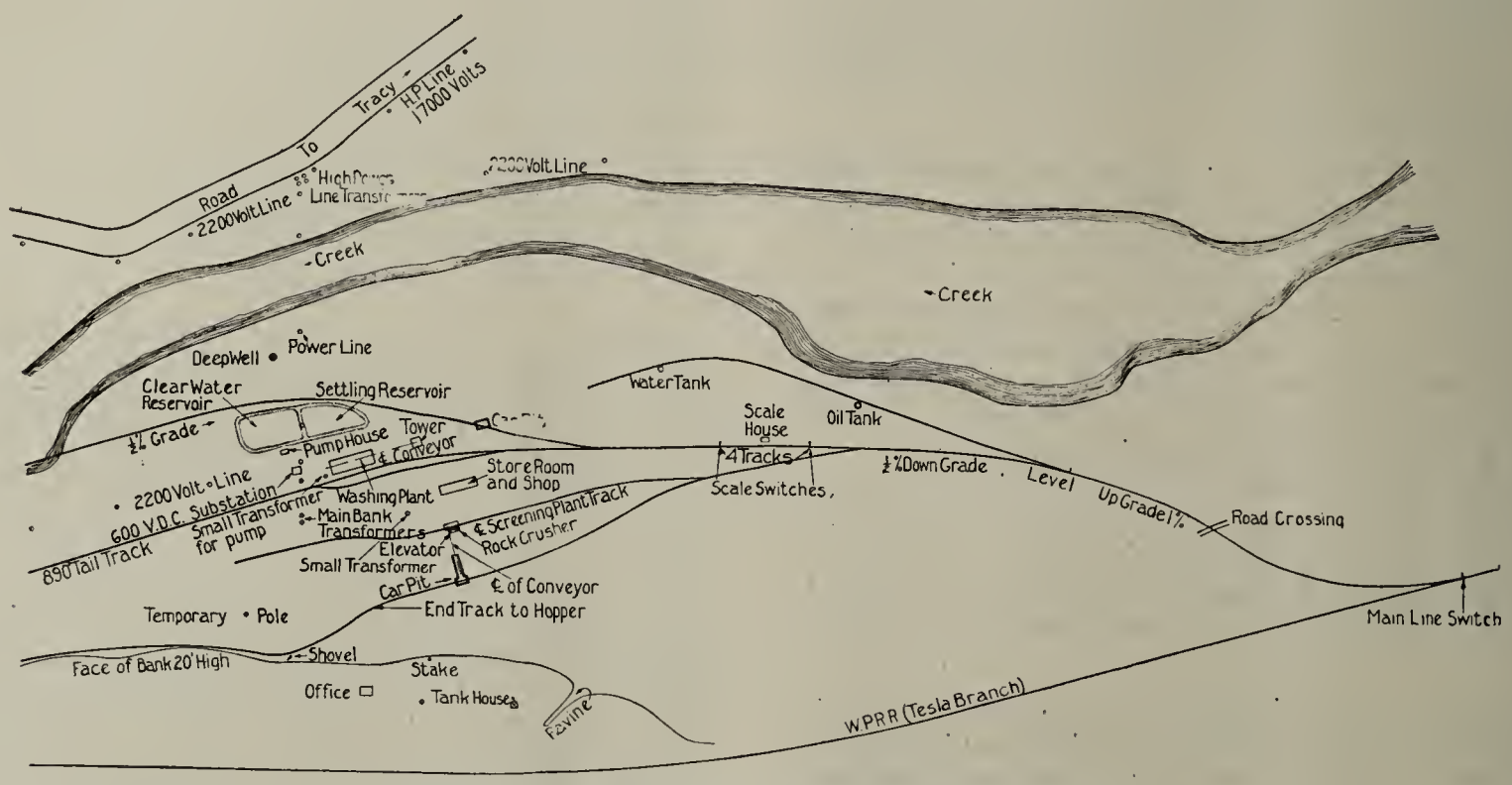
tors was that no overhead obstructions would be permissable as the drag-line excavator would be required to operate at any point on the haulage system in the channel and the locomotive crane would operate at any point in the washing plant yard and on the shipping spur and car storage tracks. The booms of both equipments require an unobstructed sweep from both sides of the tracks and over them.

The fact that considerable discarded track rail was available for the construction of the third-rail, and that overhead clearance was required for gravel handling equipment as well as loading cars from chutes at the washing plant bins, made this choice of contact system the logical one. The results of experience have shown this system to be an extremely simple one to install with ordinary track labor.

As soon as it was decided to electrify, the track gang was instructed to replace every fifth tie by one a foot longer than used for standard gauge. The third-rail was located 26¾ inches from the gauge line of the adjacent running rail and 6 inches above it. This location gives a liberal clearance from the standard main-line equipment which is used for haulage and shipment of materials.

As the track ballast is gravel, and seven or eight months may elapse without rain, the hazard from contact by workmen is greatly reduced. Suitable protection has been installed at points in the washing plant yard and at th edumping pits. As main-line train crews occasionally switch in the plant yard, an electric section switch is provided at the yard limit, and the third-rail so sectionalized that the portion of track over which such crews are switching may be de-energized.

As the Monighan drag-line excavator is working progressively up the creek channel, the contact system lends itself readily to extension. The excavator prepares the track roadbed. The track gang lays the ties, track, and installs the third-rail insulators on extended ties. The train crew, consisting of locomtive operator and brakeman, mounts the third-rail on blocks and installs temporary bonds. Time is given for this work while the drag-line excavator is loading the grizzly car.



Map of the River Rock Gravel Company's Plant

Th elocomotive is provided with a reel and 200 feet of cable which extend the operating zone of the loading point 200 feet beyond the end of the third-rail. The use of the cable also makes it unncessary to install third-rail in the vicinity of the loading point where large boulders falling from the grizzly car might damage the insulators, the third-rail, or its protection in the vicinity of grade crossings.

At storage piles it is found advisable to install bulkheads about 18 inches above the roadbed to prevent the

Fig .3. Monighan Electric Drag-line Excavator Loading Grizzly Car with Electric Locomotive in Foreground. Two members of the track gang may be seen grading and laying track just ahead of the grizzly car

Fig. 2. General View of Tesla Creek Channel showing Monighan Electric Drag-line Excavator in the Foreground, Railway Running to Washing Plant in the Distance and Storage Piles in the Vicinity of Washing Plant. The flat level country of the San Joaquin Valley is seen in the background

spilling of materials against the third-rail. This protection also makes it easier for the crane operator to load materials from the storage piles to the cars as it acts as a guard to prevent the bucket from grounding the third-rail when material is being picked up from a point close to rail.

As the maximum distance of haulage to the washing plant was uncertain at the time the system was

Fig. 4. View of Electrified Steam Orton & Steinbrenner Locomotive Crane Unloading Cars to Storage Piles

being designed, as considerable light rail might be used in the third-rail construction, and as temporary bonding or no bonds on either running or third-rail might have to be resorted to at times, the highest practical direct-current voltage adaptable to the required locomotive and crane equipment was adopted; viz., 600 volts.

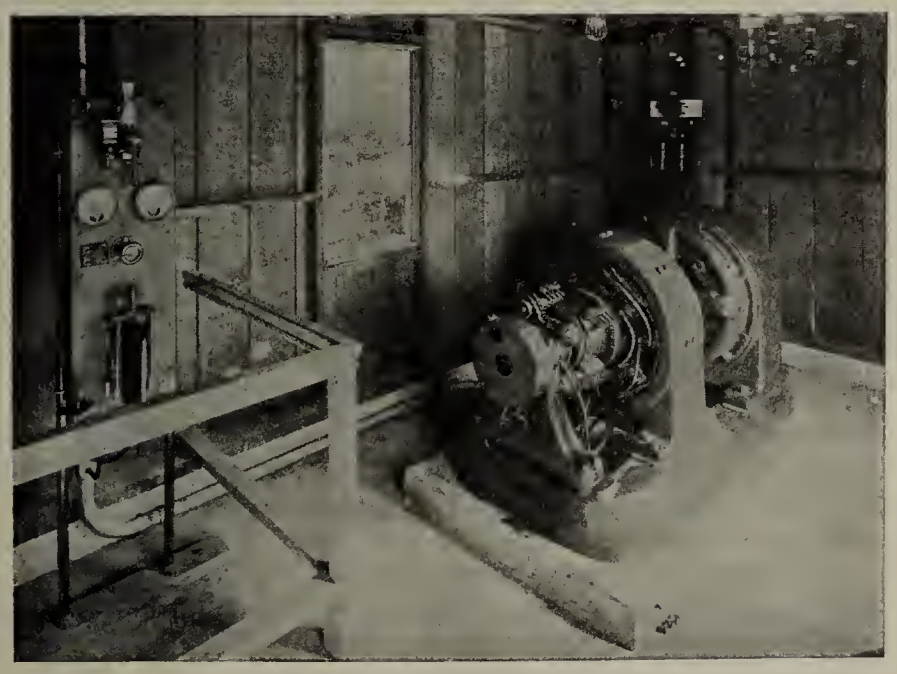


Fig. 5. The Motor, Control Board, Resistors, and Air Compressor of the Electrified Locomotive Crane

Electric Drag-line Excavator.

The Monighan electric drag-line excavator is equipped with a 1½-yard bucket, a 95-h.p. hoist motor, a 50-h.p. swing motor, and a manual remote-control panel. Both motors are of the 3-phase 60-cycle 440-volt variable-speed type. This equipment has been in almost continuous service for seven years. Its radius of operation, and its flexibility in handling and loading material is very much greater than is possible with a shovel-type excavator.

Grizzly Car.

The grizzly car is a standard gondola with a superstructure on which are mounted inverted sections of 56-lb. T-rails. The rails are placed at an angle of approximately 45 degrees with the horizontal, and the clearance distance between rails is about seven inches. This clearance is determined by the largest boulders which may pass through the gyratory crusher. The car has a capacity of about 50 tons of gravel.

Electric Locomotive.

It was difficult to prescribe a definite set of service conditions for the electric locomotive that was to haul the grizzly car between the drag-line excavator and

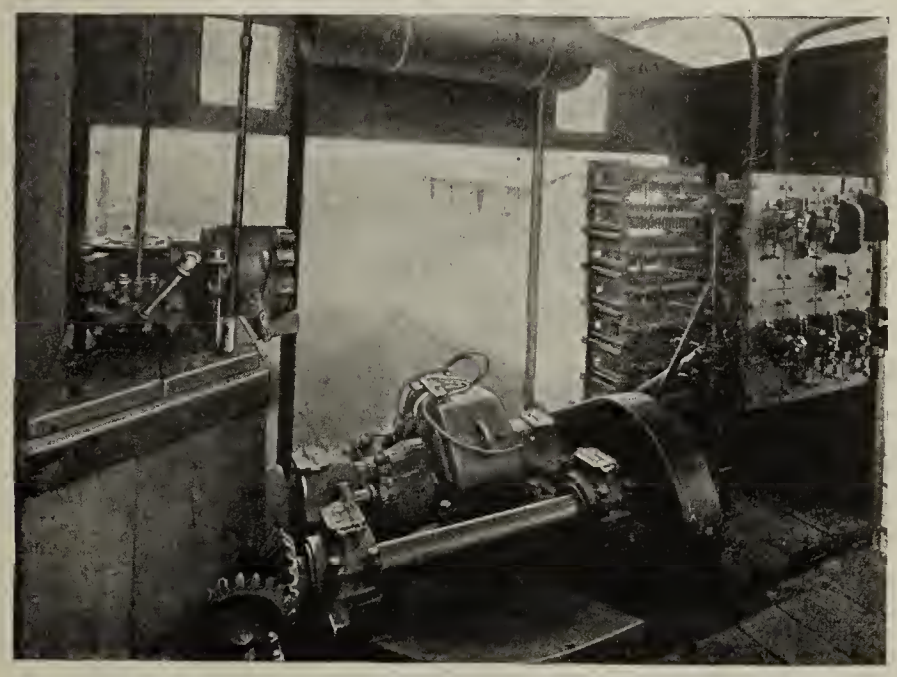


Fig. 6. Interior View of Substation, Showing 150-kw. 600-volt Motor-generator Set and Switchboard

the washing plant. The track conditions might be mucky and the spill from loaded cars might accumulate on the rails so as to block the movement of loaded cars during the critical periods of acceleration. The length of haul and the grades might exceed those pre-

Fig. 7. Locomotive Showing Operation of Cable Reel and Method of Oeprating Electric Locomotive for Distance of 200 Feet Beyond the End of Third Rail

vailing at the time the original study was made to ascertain the proper locomotive equipment. The isolated location of the plant, and the fact that no reserve locomotive would be available, led to the adoption of conservative capacities.

The locomotive selected is of the 12-ton 56½-in.

gauge single-truck type and is equipped with two 65-h.p. motors, controllers, combined straight and automatic air-brake equipment with an air compressor having a capacity of 15 cubic feet of free air per minute, cabel reel and automatic reeling equipment including 200 feet of single-conductor cable, two third-rail shoes, and other necessary auxiliaries.

An air hose is arranged on the brake system of the locomotive to permit of ready cleaning from time to time. When the wind conditions are such as to blow dust on the locomotive when the grizzily car is being loaded, the locomotive is uncoupled and moved a short distance away.

The present length of haul from the drag-line excavator to the washing plant is so short as to permit of the locomotive, in its layover time, moving cars in the washing plant yard. This service was previously performed by a steam locomotive crane at the extremely low speed of ½ to 1½ miles per hour. The quickened service afforded by the electric locomotive

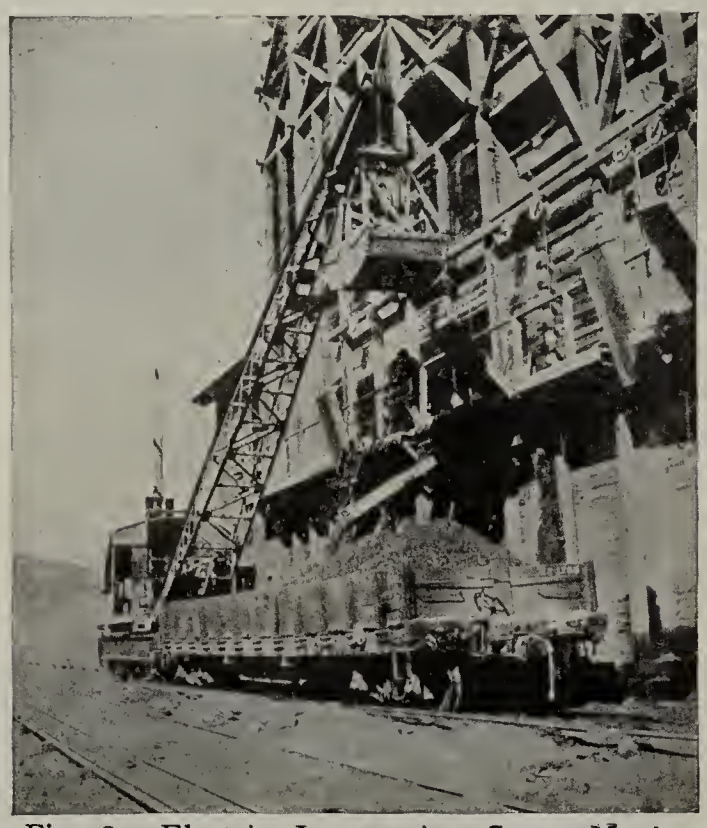


Fig. 8. Electric Locomotive Crane Moving Cars for Loading in Front of Washing Plant Chutes

permits of a more efficient use being made of the electrified crane for loading and unloading cars.

Electric Shovel.

The electric Osgood shovel, used occasionally to dig a special grade of road gravel, is equipped with a 2½-yard bucket, 2300/440-volt transformers, and 60-cycle variable-speed motors of the following capacities: hoisting motor 115 h.p.; crowd motor 50 h.p.; and swing motor 50 h.p.

Direct-current Substation.

The direct-current substation contains a 100-kw. motor-generator set consisting of a 2300-volt 3-phase 60-cycle induction motor direct connected and mounted on same base with a 100-kw. 600-volt direct-current generator. The set is controlled from a panel having the necessary instruments and switches.

Locomotive Crane.

The Orton & Steinbrenner locomotive crane has been converted from steam to electric operation and is used for moving cars in front of the loading chutes of the washing plant, for loading and unloading cars at the storage piles, and for moving cars from the washing plant yard to the main-line spur for shipment.

In studying the plans for the electrification of this steam operated crane, the problem resolved itself into the following features:

The actual work required of the crane and locomotive functions.

The mechanism of the crane and methods of operation.

The dismantling of the steam equipment to be discarded.

The selecting of appropriate motors and control.

The locating of the motors and control equipment.

The locating of the connecting shaft between the motor and the crane main driving shaft.

The determining of the gear ratio between the motor armature and the main driving shaft of the crane mechanism.

The mounting of collector rings on the crane turntable and the running of power circuits from the third-rail shoes to the collector-ring brushes.

The providing of an air supply for use with the old steam brake equipment.

The reballasting of the crane turntable to compensate for the changes in weight and location of the equipment.

Performance.

The following service conditions were decided upon as being typical, after actual observations were made and conservative averages determined.

The spotting of three standard gondola cars with a trailing load averaging 83 tons total and a maximum of 165 tons total at a speed of one-half mile per hour; the train to move 70 feet maximum at this speed in one direction and then return; and this operation to be repeated with power on for 10 seconds and off 30 as an average condition. The loading and spotting of the three cars will take from 30 to 40 minutes. The train will move on a level tangent track in good condition. The loaded cars will then be moved about 100 feet on level tangent track at a speed of one mile per hour. The locomotive crane will be uncoupled and will give the cars a slight push, after which they will run down grade coasting for a distance of 500 feet to the main-line railroad shipping point.

Another class of service is the moving of materials from bunkers to storage piles. In this case one or two cars, averaging 55 tons and a maximum of 110 tons during spotting, will be moved as previously described except that the time for spotting and loading will be reduced 20 to 25 minutes. The distance which the cars move during spotting and loading will be the same, i.e., 70 feet.

After loading, the train will move about 100 feet on level tangent track at a speed of one mile per hour and then down a one-half per cent grade of tangent track at a speed not exceeding two miles per hour.

Upon arrival at the storage piles the crane and bucket feature go into action and the following typical cycle of duty is performed:

Bucket with maximum load	11,200	lb.
Bucket with average load	9,000	lb.
Lifting speed	115	ft. per min.
Average distance lifted	18	ft.
Closing of bucket on load	8	sec.
Returning of bucket	10	sec.
Dumping load	4	sec.
Average swing of boom	45	deg.
Average direct-current voltage	550	volts
Average weight of material in cars to be unloaded	40	tons

After the cars are unloaded they are moved back up the 1½ per cent grade for a distance of 550 feet at a speed of 1 to 1½ miles per hour, and the spotting and loading operation is repeated. There is a 15-minute

average layover between the cycles of duty described, although this may be as low as five minutes for a ten-hour day and longer when plant conditions are normal.

Crane Mechanism.

The original steam equipment of the locomotive crane included a two-cylinder (10-in. bore, 10-in. stroke) engine having an original rating of 100 h.p. at 300 r.p.m. and a 60-h.p. boiler at 125 lb. per sq. in. but operating at an average pressure of 90 lb. per sq. in. The ratio between the engine drive shaft and the truck axle was 6½ to 1

As the steam engine was non-reversible, the reverse operation of the various crane and locomotive functions was accomplishel through clutches. The "tag line" drum was mounted on a friction which must revolve in only one direction to keep a steadying pull on the line running to the bucket frame. When planning the electrification, a non-reversible control was adopted so that no change in the handling of the clutches would be made to confuse the operator. The only change in the operating mechanism of the original equipment was in the design of the main driving shaft. The original shaft had an extension beyond the supporting bearings for crank pins. The replacing shaft is similar in all respects inside the bearings, the shaft extension on one end being eliminated while the extension on the other end has a seat for the bevel gear which meshes with pinion on the connecting shaft that is geared to the back shaft of the motor.

The removal of the engine, boiler, oil and water tanks, and steam piping provided a liberal space for the installation of the electrical equipment and the mechanical connections between the motor and crane.

Selection of Motor and Control.

A series motor and semi-automatic control was adopted as being the most suitable for the overall performance of the crane. While it was appreciated that it would be possible for the operator to unclutch the load from the motor while the power was on, this condition was not considered to be serious because the motor would be permanently tied in to the back shaft, the connecting shaft, the main crane driving shaft, which in turn is permanently geared to all the clutch shafts. The noise of this gearing when racing would give an audible warning in the event that full voltage was applied to the motor without clutched load. The identical principle had applied to steam operation and the handling of the throttle. The motor is equipped with a speed-limit switch which opens the control circuit and drops out all the power contactors when the armature attains a speed of 15 per cent over that at rated horsepower.

The control equipment is arranged to give positive power on the first and second notches. If the controller is moved beyond to the third, fourth, and fifth notches, additional contactors will not come in until the current has fallen to a predetermined point on each notch. The current relays on the contactors controlling the automatic points are adjustable over a wide practical range. If the circuit breaker trips, it is automatically reset by moving the controller to the "off" position. The controller is mounted so that the handle is in practically the same position as the old steam throttle.

Location of Motor and Control Equipment.

As the boiler and fuel tanks occupied a greater space than is required by the motor and other electrical equipment, the main point in determining the layout was to place the weight as far out on the cab underframe as possible to give the maximum counter-balancing effect to the boom side, to give easy access for inspection and maintenance, and to make the floor plan as spacious as practical for the operator.

Since without extensive changes in the original crane machinery it was not possible to gear the motor directly to the main driving shaft, a connecting shaft was used making it possible to place the motor in the most convenient location.

Gear Ratio.

The electrification of the locomotive crane was worked out in conjunction with the original designers, they advising the layout of the connecting shaft and bearings, and the location of the motor feet to the underframe members. The gear reducion from the motor to the back shaft and the main driving shaft of the crane was also determined by them, after a careful study of the energy and speed of the main shaft required to fulfill the service conditions. It was the duty of the motor and control designers to calculate the energy at the bucket, turntable, and locomotive axles, and upon the assumption of mechanical losses back to the motor, check this energy against the characteristic of the motor selected and the energy it is capable of delivering at various speeds.

The gear reduction from the motor to the back shaft is 3½:1. The bevel pinion on the back shaft has 24 teeth driving to a 24-tooth gear on the motor end of the connecting shaft. The pinion on the crane end of the connecting shaft has 31 teeth and the gear on main driving shaft has 17 teeth bevel gearing. The diameter of the connecting shaft is 3½ inches. A bearing and thrust collar is mounted at each end of the connecting shaft.

Turntable Collector Rings and Brushes.

Two cast-iron collector rings and suitable brushes were installed to complete the circuits from the third-rail shoes to the revolving turntable. The rings were mounted on simple wood supports on the main or stationary underframe of the crane and in a position concentric to the center post or support of the crane turntable. The brushes were mounted on the turntable. The collector rings and brushes are similar to those furnished with locomotive crane equipment made originally for electric operation. There are two steel-spring-actuated brushes or shoes per ring, located at points diametrically opposite, so that any tilting of the turntable incident to operation will not break the connection.

Air Supply for Brakes.

As the crane was originally operated, steam was used for braking purposes. Compressed air on the renovated equipment is furnished by an electrically driven air compressor having a capacity of ten cubic feet of free air per minute, and rated for 45-minute operation per hour at 600 volts. An electric governor switch cuts in the compressor at 65 pounds and out at 75 pounds per square inch. An air reservoir and whistle are also provided. The original steam brake valve and piping is retained.

Plant Operation.

An observer on the top of the washing plant watches the height of the various grades of material. The bins are numbered and when full a large number is displayed at a conspicuous place for the information of the yard gang. Empty cars are then brought to the proper chutes, are loaded, and moved to the storage piles and unloaded or the material held in the car for shipment.

The comparatively short period of operation of these equipments by electricity prevents an extended analysis and comparison with previous steam operation, but the period has been sufficiently long to make apparent the advantages in favor of electrical operation.

A survey of the plant failures when the locomotive crane and the locomotive were steam operated shows that the slackening in the plant output and the chief cause of overtime were directly attributable to boiler and steam equipment troubles. Since the complete equipment has been electrically operated, no delays have occurred which could be attributed to electrical failures and no overtime has been necessary for which electrical failures were responsible. The hostling of the locomotive crane and locomotive has also been completely eliminated. Without regard to the time of day or night that it might be desirable to start up the plant, no preparation now has to be made so far as power requirements are concerned.

The operators of the locomotive crane and locomotive are highly pleased with electrical operation. In hot weather, which attains extreme temperatures, the comfort of the operator is increased. There are no gauge glasses or boiler to need attention. A given controller position always produces similar power conditions. When steam was used, the operators were constantly kept on their nerve by the continual rising and falling of the pressure necessitating their "feeling" for the load by manipulation of the throttle. This advantage of electricity over steam is particularly noticeable on the steam locomotive crane where the operations of swinging, closing bucket, lifting and swinging, and swinging and lowering are carried on in rapid succession and some of the operations simultaneously in which case the operator puts his controller on a given point, removes his hand, and is thus allowed two hands to operate the clutches and brakes. Experience has shown the proper point on the controller for each operation and they follow in rapid succession.

The elimination of stand-by losses is important. In variable load work, with coal or oil as fuel and where the operator cannot give his undivided attention to boiler pressure and feed water, the natural tendency is to always play safe and "have her blow off" rather than be handicapped by low boiler pressure. Oil firing lends itself to variable steam demands better than coal, but even with oil fired locomotives and cranes it is safe to say that fifty per cent of the fuel is burned in maintaining the boiler pressure when not needed for actual operation. Prior to electrification, oil was burned at the rate of 238 bbl. (10,000 gal.) per month, the oil costing $1.70 per bbl.

Data.

Electric locomotive supplanted the steam locomotive February 20, 1919.

Elecric crane equipment supplanted the steam crane equipment, May 27, 1919.

Overtime for hostling steam locomotive and crane:

2 hours per day for locomotive at $0.55 per hour	$1.10
1 hour per day for crane at $1.00 per hour	1.00
	$2.10

This hostling charge amounted to $54.60 per month or $655.20 per annum.

Washing out locomotive boilers and cleaning flues (estimated)	$20.00 per month
Washing out crane boilers and cleaning flues (estimated)	$20.00 per month
	$40.00

This charge amounted to $480.00 per annum.

Saving per annum by eliminating fuel oil	$4048.00
Saving per annum by eliminating hostling	655.20
Saving per annum by eliminating washing and flue cleaning	480.00
Total	$5183.20

The details of actual maintenance costs of the steam locomotive equipment have not been kept but some of the features of maintenance may be used as an index to the conditions.

Retubing of locomotive boilers	$400.00
Retubing of crane boiler	500.00

Loss of time of locomotive and crane equipment when taking fuel and water was 1½ hours in 18 machine hours.

Conclusion

A knowledge of the performance of this class of electrical equipment in other places makes it safe to assume that for several years to come the maintenance will be limited to the following:

Brake shoe maintenance.
Third-rail shoe maintenance.
Brush and small electrical contact renewals.
Journal brass and motor-bearing renewals.
Miscellaneous renewals such as incandescent lamps.

Concerning the matter of operating cost, Mr. A. D. Schindler, consulting engineer of the property, furnishes the following interesting information:

"During the five months from October, 1919, to March, 1920, inclusive, which period is fairly representative of general results, the plant manufactured 67,420 tons. The total power bill for that period covering the entire operation was $1,510.43, a unit cost of 2.24 cents per ton. During the corresponding period of the previous year the bills for power, fuel oil, and locomotive repairs amounted to $3,028.88. No record was kept of the tonnage manufactured during this time. The assumption is made, however, that the tonnage was the same as that of the year following, on which basis the unit cost for power would be 4.5 cents per ton or practically twice that of the later period. As a matter of fact, the production during the earlier period was probably considerably less than is assumed, which would raise the unit cost to a still higher figure."

American Concrete Institute Elects

Delegates to the American Concrete Institute, in convention recently at Cleveland, elected the following officers.

W. P. Anderson, of Cincinnati, president; A. E. Lindau, Buffalo, first vice-president; M. M. Apson, New York, second vice-president, and Harvey Whipple, Detroit, secretary and treasurer. New directors elected are E. D. Boyer, New York; Charles E. Nichols, Boston, and Arthur Bent, Los Angeles.

There are two reasons for not being a member of the American Concrete Institute:

(1) Lack of direct interest in the study of the best way to do things with concrete.

(2) Lack of ten dollars a year for dues.

We mention this because the Institute is engaged in a membership drive. It has doubled its membership in two years—from 383 to about 800. It wants to have a thousand members within the next 30 days. It wants this additional membership strength for two reasons: to increase its income and to have the help of the members on committees and otherwise in solving a lot of problems which beset the fellows, in the Institute and out, who are designing, manufacturing and building with concrete. Solving these problems raises the standards under which all of us work. When we raise our standards and sustain them, we raise ourselves. The address of the Secretary of the Institute is 314 New Telegraph Building, Detroit, Mich.

Crushing Plant Engineering*

Entering a New Phase—Day of Pioneering Without Adequate Data is Over, by Brownell McGrew, Engineer, Allis-Chalmers Mfg. Co., Chicago, Ill.

The process of producing crushed stone and putting it on the market may be divided roughly into three main groups of activity—quarrying, crushing and selling.

Andrew Carnegie, when asked which of the three economic factors—capital, labor, or materials—he considered the most important, answered, "Which is the most important leg of a three-legged stool?" Mr. Carnegie's remark applies very aptly to the three divisions of crushed-stone production. If one leg is short you have at the best a wobbly stool, and a two-legged stool is no stool at all.

Between the primary operation of quarrying and the final one of marketing stands the crushing plant—the neck of the bottle through which the commodity must be poured to prepare it for the market. It seems to me, therefore, that a brief discussion of the principles of crushing plant engineering cannot but be of interest to you all, because upon the forethought and judgment that have gone into the crushing plant's original design, or its subsequent remodeling, depend in a very large measure the success of your operation as a whole.

There is probably no branch of industrial engineering in which the individual judgment and "common sense" of the engineer are of greater importance than in the crushed-stone industry.

Naturally, there is considerable difference of opinion as to what constitutes "common sense"; it is not surprising, therefore, that there is a considerable difference of opinion as to what constitutes good crushing plant engineering, particularly in view of the fact that there is no fixed standard or criterion by which to compare one crushing plant with another.

Furthermore, crushing practice has gone forward by leaps and bounds in the past two decades, and what was good engineering in the light of yesterday's experience may not be good engineering in the light of our present-day knowledge.

There are, however, a few sound basic principles upon which all successful engineering must be based, a few standards that any efficient plant must measure up to.

Effectiveness of Operation.

The first of these—EFFECTIVENESS—is the most important measuring rod that can be applied to an industrial plant of any kind.

Will the plant do what it was designed to do?

As regards the crushing plant effectiveness bears directly upon capacity for one thing, and here we have one of the greatest stumbling blocks for the unwary designer.

Adequate capacity must be provided for throughout the plant; in the main breaker, the secondaries, screens, elevators, hoists.

Not only must the plant be capable of crushing a certain tonnage in a given time, but it must also be capable of reducing the stone to marketable sizes and properly separating, grading, and perhaps remixing certain sizes.

The demand for clean stone, properly graded, is becoming more and more insistent, and the wise operator is putting his plant in shape to meet this demand.

Likewise there is an ever-increasing demand for the smaller sizes of crushed stone for reinforced concrete work, highway binder, etc., and the modern commercial plant to be fully effective, must be prepared to deliver these grades in large quantities.

Plant Capacity—Primary Breaker.

Ordinarily when plant capacity is mentioned the mind jumps instantly to a consideration of the proper size of primary breaker, for there is probably no one factor in a crushing plant that has so far reaching an effect, from a dollars and cents standpoint, as this machine.

Aside from the element of capacity the size and type of primary crusher influences directly practically every unit in the plant that follows it, and frequently the disposition of these units.

Looking at it from the plant side the most economical breaker is the one that will deliver to it the smallest product—and a product that is relatively free from slabs and fines. Looking at it from the quarry side the most effective crusher is the one that will cut to a minimum the cost of drilling and shooting.

Herein lies the chief advantage of the big receiving opening.

Mr. Edison's line of reasoning when he first developed the Edison roll crusher was as follows: "A pound of coal and a pound of dynamite have approximately the same potential energy value, but a pound of dynamite costs from eighty to one hundred times as much as a pound of coal; therefore why not do as much of the work as possible with coal rather than with dynamite?"

The development of the large crusher and the introduction of the steam shovel into quarry operation are without doubt the two most important improvements that have been made since the inception of the industry, and it is safe to say that development along these lines has not yet reached its limit.

On the other hand, it should be remembered that for any given set of conditions there is an economical limit to the size of primary crushers.

Figuratively speaking, one must stand in the middle of the proposition and look both ways.

On the one side we have the very enticing possibility of making a substantial cut in the cost of quarrying; on the other we are checked by the factors of first cost, power, upkeep, ratio of reduction, etc.

Effectiveness of Location.

The relative effectiveness of a plant will also depend to a very considerable extent upon its location.

Primarily this involves the problem of quarry transportation, of getting the stone from pit to plant as cheaply as possible.

Second only to this in importance is the problem of getting the stone away from the plant and of providing ample storage room for both empty and loaded cars.

It is frequently the case that a location which is advantageous from a standpoint of transportation in the quarry will complicate the handling of the railroad cars, even to the extent of necessitating the use of a locomotive to do the loading.

You will, of course, wish to avoid this when possible; nevertheless it should be remembered that the ton-mile cost of handling the finished product in railroad cars will be very much lower than that of making long hauls in the quarry.

Furthermore, in large commercial operations the locomotive is sometimes necessary—or at least very expeditious—for loading mixed sizes and cutting out required types and capacities of cars needed to fill certain orders.

---

*Paper read at 1922 Annual Convention of the National Crushed Stone Association.

Continuity of Operation.

Effectiveness is also the measure of a plant's ability to operate continuously throughout the season with a minimum of breakdowns or delays from other causes.

Rugged and dependable machinery is the best safeguard against breakdown, and a simple layout, comprising the absolute minimum number of units necessary to do the work is the best safeguard against minor delays and accidents.

A principle of crushing plant design second only in importance to effectiveness is that flexibility which, in its broadest sense, is the measure of the plant's ability to meet a varying market demand.

Those of you who are operating plants which do not have this element of flexibility have probably experienced more than once the necssity of turning down orders for certain grades of material, while at the same time you were overstocked on other sizes.

I have mentioned before the increasing demand for the smaller sizes of stone, and the necssity of equipping the plant to take care of this demand. I do not propose in this paper to discuss the various types of fine crushers and their relative merits, but I do wish to lay special emphasis upon their value to the operator.

Good Crusher Practice—Closed Circuits.

Fine crushing machines should be so located in the plant that any of the coarser sizes which may be temporarily unmarketable may be readily returned to them for re-crushing.

The value of the closed circuit principle in crushing plant design is so well known, and the principle is so generally adhered to that it would scarcely seem necessary to mention it here. Nevertheless there are still a rather surprising number of plants in operation which are wide open on the finishing end.

This is most frequently found to be the case in plants where the product of the secondary crushers is returned to the scalping screens for re-separation, making a closed circuit at this point and sending on to the finishing screens all material under the maximum size produced.

This is good practice in a straight ballast plant, but is hardly excusable in a general commercial mill as all adjustments in product must be made by changing sections in the scalping screens—whereas in the closed circuit plant changes in product can be made while the mill is in full operation.

Stock Piling.

Most of you, no doubt, are equipped in some way or other to stock such grades as may be unsalable at the time they are made.

The stock pile is coming to be a very necessary adjunct to the commercial crushing plant as there seems to be no other method of adequately taking care of a fluctuating market.

It is but natural, though, that the quarryman should not be inclined to look with favor upon the stocking of crushed stone—not only because of the expense of rehandling, but because stone in the stock pile represents dead capital.

It is not possible in the light of our present knowledge to put up a crushing plant that will entirely eliminate stocking, but it is practicable to so equip the plant that stocking of the larger sizes will be unnecessary when there is a heavy demand for the smaller grades.

Advantages of Electric Power.

The introduction of the electric motor into the crushing plant has been a great boon to plant flexibility; in fact, I do not believe I am going too far when I say that no other one factor approaches it in importance.

The freedom which it allows in the disposition of the various plant units was impossible under the older system of centralized drive. Nowadays the designer can arrange his machinery with very little thought of complications in power transmission by adopting the group or individual drive—thus sidestepping one of the greatest checkreins upon flexibility.

Broadly speaking, simplicity in plant design is attained in two ways: First, by reducing the number of units to a minimum, and, second, by simplifying the arrangement of these units and their auxiliary equipment.

A crushing plant is not merely an aggregation of machines—it is in itself a machine—dependent upon the efficient operation of its parts for its success as a whole.

Every part added to a machine—and, likewise, every machine added to a plant entails additional power and upkeep expense, and other things being equal, the plant with a few large units can be operated more economically than the one which is made up of a large number of small units.

I would not advocate that this principle be carried out at the sacrifice of flexibility, nor would I wish to set it up in opposition to the independent two-unit plant, which in my opinion constitutes a great feature of modern high capacity plant design.

There is a happy medium which good judgment will point out to the designer for each particular proposition.

Compactness in Design

Compactness will go hand in hand with simple plant design; its greatest value to the quarry operator lies in the saving of labor required to run the plant—and in the first cost of the buildings that house it.

A plant that is scattered all over a 10-acre lot is naturally going to require a larger operating crew than one that is housed in one building or in two buildings closely adjoining each other.

Like all good things, though, compactness can be carried too far. Accessibility—which is an oft neglected but none the less valuable feature—should never be sacrificed for the sake of obtaining a compact layout or cutting down the size of the buildings.

It would be a very good thing if every man responsible for a "sardine can" plant design could be made to get out and make a few repairs in it on a dark night. There would certainly be some startling improvements along the lines of accessibility in their future work.

Accessibility of Machinery.

The screen house should be large enough to provide plenty of room around the screens; where screens are arranged in battery, room should be allowed for getting at each unit from at least one side.

Elevator pits should be made large and be well lighted, and it is best where possible to arrange for access to the pit from the rear so that the men who have to enter it will not be in danger of being caught in the buckets or struck by falling stones.

Safe runways and stairs should be provided for getting at overhead shafting; only an exceptional man will pay the proper attention to inspection and lubrication when this work involves undue fatigue or personal danger.

Much can be done in the average crushing plant to promote this feature of accessibility—not only as regards repairs, but also with respect to operation.

I have in mind a small plant in the East that was originally designed with the incline directly over the

top of the primary crusher and at such a height as to prevent free access for feeding. This plant was equipped with a No. 6 primary machine.

After operating under this handicap for several seasons the incline was shifted to one side and raised so that the feeders were unhampered in their work—and the average output of the plant was increased 50 tons per day.

Selecting Crusher Types.

The question of selecting the right type of crusher is one of the most widely debated questions among quarrymen and engineers. It is not surprising that this should be so.

My own observations lead me to believe that there have been more costly mistakes made in choosing the type of crusher to be used than in any other branch of crushing-plant design.

I believe we all have a very human tendency to become unduly enthusiastic over the merits of that particular type whose performance has been most favorable in our own personal experience. Also, the introduction of a new type, or its development in large sizes invariably instigates what might be called a short period of "faddism."

I have been fortunate enough during my own erecting and operating experience to come in contact with all of the three general types of main breakers and I will have to confess that, at one time and another, each of the three was a heavy favorite with me.

The truth of the matter is this: Strictly speaking, there is no such thing as a universal crusher. I believe you will all agree with me that the gyratory more nearly approaches this definition than any of the other types, but even the gyratory has its limitations.

The man who is going to put his money into a new crusher will do well to make a careful study of the characteristics of all of them—to check these characteristics against the material to be crushed, the product desired, and the capacity wanted.

Only after such a comparison will he be qualified to make an intelligent selection of the right type for his particular work.

Study the Flow Sheet.

One phase of crushing plant design that deserves more attention than is generally given it is a study of the flow sheet.

We all know that no two classes of rock have the same fracture and that for this reason a flow sheet can only be an approximation of what will actually take place in the plant. But even this approximation is vastly better than a rough guess, and anything that will help to eliminate guesswork is most certainly a step in the right direction.

The industry in general is in need of more scientific plant design—of a discarding of many of the old rule-of-thumb methods in favor of more systematic methods.

The older and more experenced engineers carry in their memory certain more or less clearly formulated rules and data which they are able to apply offhand to crushing plant problems as they arise; but the coming engineer is going to need more than that; he is going to need these rules and data and the results of the older engineer's experience in printed form; in order that he may have a starting point from which to carry on.

Such rules as there are to guide the crushing engineer must necessarily be empirical in character, and to be safe they must be based upon data which for any particular formula may take years to compile.

Operators Must Contribute Experience.

These data must come chiefly from one source—from the operator—and anything that can be done to promote closer cooperation between the quarryman, the machinery manufacturer, and the engineer, for the purpose of furthering our present-day knowledge of crushing stone cannot help but benefit the industry.

What I have designated as scientific design should not be confused with conservative design.

It is safe to say that 95 out of every 100 plants represent what might be called conservative design.

Conservatism consists largely in profiting by your own and the other fellow's mistakes, or in a repetition of your own and the other fellow's successes.

Scientific principles will be more in the nature of a guiding light for the progressive quarryman and engineer—the men who are on the alert to try something new.

New Book Manufacture of Portland Cement

By ARTHUR C. DAVIS

The third edition of the new book on the manufacture of portland cement by Arthur C. Davis is just off the press. Revised and enlarged, 8½x6 inches, 416 pages, flexible leather cover and enlarged, 100 illustrations. It is published by John Falconer, 53 Upper Sackville street, Dublin, Ireland, who has the following to say concerning this work, viz: "The Authors' Lectures at the University of Cambridge upon the modern manufacture, testing and use of cement, and those more recently delivered for the Royal Society and the Institution of Civil Engineers (and for which Mr. Davis was awarded the Mullins Silver Medal), have awakened a new interest in the science and technology of Portland Cement. I have thus decided to publish a third edition of the Author's book on the subject for the information of cement users.

"The entire contents of the second edition have been rewritten and brought up-to-date by the insertion of matter dealing with the latest available information concerning the manufacture and testing of Portland Cement, including a description of the newest labor saving devices and testing appliances and methods, and the latest theoretical conclusions as to its constitution.

"The Author has taken pains to make the science of cement an easy subject for study by the consumer, and the valuable illustrations included in this new issue add additional interest and will further explain the text to those readers whose business it is to treat with Portland Cement."

The contents of this new book are as follows, viz: Composition of Portland Cement, Mineralogy of Cement, Raw Materials, Raw Materials—Mixing, Estimation and Analysis of Raw Materials, Burning of Calcining, the Rotary Kiln, The Rotary Kiln—Fuel Valuation, Efficient use of Fuel in Rotary Kilns, The Rotary Kiln—Flue Gas Analysis, The Rotary Kiln—Historical, Clinker Grinding, Motive Power and Factory Efficiency, Chemical Analysis, Mechanism of Setting and Hardening, Sampling, Testing and Uses, Fineness and Sieving, Tests for Bushel Weight and Specific Gravity, Setting Tests, Soundness, Contraction and Expansion, Tensile Strength Test, Compression and Transverse Tests. Send on receipt of price ($6.25) by John Falconer Publishing Co., 53 Upper Sackville street, Dublin.

Concrete Road Specifications

By H. K. Bishop, Chief Engineer Indiana State Highway Commission.

There is a wide range of opinion and more or less disagreement among highway engineers relative to the proper specifications for the construction of cement concrete roads. The Indiana State Highway Standard Specifications were prepared after considerable study of specifications of other States, and after consultation with some of our most experienced highway engineers. In writing this article, however, the writer does not wish to be understood to infer that the specifications prepared for Indiana are the best possible specifications for cement concrete road construction. The following will attempt to bring out some of the points with regard to cement concrete road construction which we believe important and essential to the construction of a proper cement concrete road.

Taking the Indiana Specifications as a guide, the writer will cover under the various headings, the important matters to be considered in the preparation of specifications for one course plain cement concrete pavement.

Description.—Under this heading should be stated briefly the character of the pavement to be built and reference made to the Plans and Specifications which should give the width and depth of the pavement.

Portland Cement. Specifications for Portland cement usually can be made very brief, such as—"All cement used in this work shall be Portland cement which will conform to the requirements of the United States Bureau of Standards, Circular No. 33." A specification like the above fulfills all purposes and avoids a lengthy description in the body of the text. All parties interested can be furnished with copies of the circular mentioned.

Fine Aggregate. One of the most important materials used in the construction of cement concrete roads is the fine aggregate. This fine aggregate usually consists of sand. In Indiana we are particularly fortunate in having good sand and the only material used for fine aggregate today, is sand. The specifications for sand, in addition to requiring that it be clean, hard, durable grained, etc., provide that when dry, 100 per cent shall pass a laboratory screen having circular openings one-quarter inch in diameter and shall be graded from coarse to fine. In addition to this, we provide that not more than 5 per cent by weight, shall be removed by the elutriation test. In-as-much as it is results that we are after, it would seem that the strength test is extremely important. It is usually customary in writing specifications to provide that mortar composed of one part by weight, of Portland cement and three parts by weight of sand shall have a tensile strength at the age of seven (7) days and twenty-eight (28) days of not less than 100 per cent of that developed by mortar of the same proportions and consistency made of the same cement and standard Ottawa sand. In this State we are particularly fortunate in having a sand which will show a strength ratio of anywhere from 125 per cent to 190 per cent. It would seem to us, therefore that the proper points to be covered in writing specifications for sand in cement concrete pavement, are the grading and the strength ratio. The grading to be specified will depend somewhat upon the local sands available. With our Indiana sands we are inserting an intermediate grading in our 1920 specifications, requiring that not over 50 per cent shall pass a No. 30 laboratory sieve. If stone screenings are allowed, it would seem advisable to raise the strength ratio requirement above that required for sand. There is evidence to substantiate the claim that a mortar composed of sand and stone screenings showing an equal strength ratio with standard Ottawa sand in the laboratory, will not develop the same strength in actual practice. It is therefore customary in many specifications to require an additional strength factor when combinations of sand and stone screenings are used.

Coarse Aggregate. The Indiana Specifications allow the use of crushed stone, screened gravel and, more recently, slag. Too much importance cannot be attached to the proper specifications for coarse aggregate and the proper inspection of material during construction. The specifications in addition to requiring that the coarse aggregate shall be clean, free from foreign matter, etc., should cover the grading. In Indiana the specifications provide that all of the coarse aggregate must pass a 2½ inch screen and that not more than 5 per cent shall pass a one-quarter inch screen when tested in the laboratory. We also provide that the material shall be uniformly graded from the maximum size to the smaller size. This specification, however, is somewhat indefinite and not altogether satisfactory. We have been trying to work out some intermediate grade that will suit our local material and at the same time conform to the results of the tests obtained in the laboratory. As yet we have not arrived at a satisfactory specification for the grading between the maximum and the minimum sizes.

Water. The specifications for water should require that it be clean, free from oil, acid, alkali or vegetable substances. Ordinarily water used in the mixing of concrete is given very little consideration. We have found in some instances, however, that it is important and that water containing sewage, acids and alkalies are someimes the cause of failure to obtain good concrete.

Composition. The matter of composition of concrete for cement concrete pavement is one on which highway Engineers will differ probably more than any other part of the specifications. There are certain limits, however, which might be stated as the limits between which it is advisable to work and which cover the range of good practice. These proportions are namely: 1:1½:3, 1:2:3, 1:2:3½ and 1:2:4. Theoretically the composition of concrete will depend more or less upon the character of the materials used as coarse and fine aggregate. Concrete composed of the same proportions will vary in strength due to the grading of the aggregates. Practically, however, it is generally considered good practice to adopt a combination of cement, and fine and coarse aggregate, that seems best suited to the materials at hand. Indiana has adopted the proportions of one of cement, one and one-half of fine aggregate, and three of coarse aggregate. In specifying these proportions, however, we specify that the concrete shall be composed of one part of Portland cement, one and one-half parts of fine aggregate and not more than three parts of coarse aggregate. We further specify that the aggregates shall be measured separately and accurately by volume so as to get the greatest density in strength. A further important provision is adopted in specifying that a cubic yard of concrete in place shall contain not less than 1.91 barrels of cement which is the theoretical amount corresponding to these proportions. A careful count is made each day of the cement used and the yardage laid, and the Contractor is required to con-

form to these specifications within a limit of approximately 2 per cent.

Consistency. The requirements for consistency vary in different specifications. In Indiana we have adopted those originated, I believe, in Illinois, requiring that concrete shall be such that, when a cylinder or truncated cone 12 inches in length is filled with concrete and tamped until all voids are filled and a slight film of mortar appears on the surface, and the cylinder then removed, the vertical settlement or slump of the concrete shall not exceed a certain amount.

Mixing Concrete. Specifications under this heading should be definite and we believe should be confined to machine mixing. Our Indiana specifications require that the concrete shall be mixed thoroughly in a batch mixer of the boom and bucket type. The period of mixing is important and. while laboratory tests show conclusively that the longer concrete is mixed, the greater is its strength, we believe that the economical time of mixing is one minute. The strength gained by mixing concrete one and one-half minutes is not justified by the additional cost over that of concrete mixed one minute. In addition to specifying the time of mixing, it is important to regulate the revolutions of the mixer. All mixers are designed to revolve at a certain speed in order to give the best results. A good clause covering this part of the specifications is as follows: "Concrete shall be mixed thoroughly in a batch mixer of the boom and bucket type for a period of not less than one minute after all materials are in the drum, and during this period the drum shall revolve at the speed for which that mixer is rated by the manufacturer and which shall be not less than fourteen nor more than twenty revolutions per minute." Hand mixing should be permitted only when it is absolutely necessary to finish out some section, due to a break-down of the mixer.

Placing Concrete. Under his heading, it is important to carefully specify the manner of placing the mixed concrete on the subgrade. Important points to be covered are the sprinkling of the subgrade and the thorough compaction of same. It is advisable to use a template to insure the proper thickness of the concrete. The use of a template is equally important to the Contractor to insure him against extra depth due to low subgrade.

Finishing Concrete. Until very recently finishing the concrete was accomplished by hand methods. We now have two or more finishing machines on the market that mechanically strike and finish the concrete. In Indiana for 1920, we are specifying that a finishing machine must be used. The finishing requires the striking of the concrete to section, the tamping of the concrete to bring the mortar to the surface, and the belting of same. An additional requirement which is sometimes advisable is the use of the roller, generally known as the Macon roller. The finishing of the concrete is one of the most important parts of the work of building a cement concrete pavement. In order to have the pavement ride smooth, great care must be exercised to properly set and support the forms and to strike the pavement true to section. The use of the machine, we believe, is far in advance of old hand methods.

Forms. Specifications for forms are extremely important, especially if a finishing machine is to be used. Finishing machines are heavy and are liable to have considerable vibration. This weight and vibration has a tendency to settle the forms, thus producing a warped surface of the finished concrete road. It is important that the forms be securely set and that sufficient weight be given to the form to furnish the required stiffness and also that sufficient bearing area be given to prevent settlement if possible. In preparing the 1920 specifications, the Indiana State Highway Department went into this matter at some length and finally evolved the following specifications:

The outside forms for the concrete shall be of steel, having a top flange not less than two and one-quarter (2¼) inches wide. They shall be straight and rigid, of a height equal to the thickness of the pavement at the edge, and shall conform to the following requirements:

Weight of Finishing Machine	Bottom Bearing Area per Lineal Foot	Wt. per Lin. Ft. of rail only
3000 lbs. or under	39 sq. inches	6.5 lbs.
3000 to 4000 lbs.	48 " "	8.0 "
4000 and over	54 " "	9.0 "

The forms shall be staked at intervals of not more than five (5) feet and by such means as will maintain the required alignment and grade with exactness. The stakes must be so driven as not to interfere with finishing operations.

The Contractor shall provide sufficient forms so that it will not be necessary to remove them within twelve (12) hours after the concrete is placed. Before concrete is deposited against the forms, they shall be cleaned thoroughly and oiled.

Protection of Concrete. The protection of the concrete may be accomplished by several methods, the most common of which are ponding, a cover of earth and a cover of straw. The ponding method can only be used on low grades. It is very satisfactory for curing concrete but requires considerable care. The use of earth cover is the most common form of curing concrete and specifications usually provide that the earth cover shall be applied as soon as the concrete is sufficiently hardened to receive it. The actual time differs with the weather conditions and may vary from ten to twenty-four hours. The use of earth cover has one objection,—that it usually results in digging up

---

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24 1912,

OF CEMENT AND ENGINEERING NEWS, published monthly at Chicago, Ill., for April 1st, 1922.

State of Illinois }
County of Cook } ss

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. S. Faussett, who, having been duly sworn according to law, deposes and says that he is the Editor of the Cement & Engineering News and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, I. M. Seafert, 22 Quincy St., Chicago, Ill.; Editor E. S. Faussett, 22 Quincy St., Chicago, Ill.; Managing Editor, E. S. Faussett, 22 Quincy St., Chicago, Ill.; Business Managers, John F. Waldron, 22 Quincy St., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of Stock.) I. M. Seafert, sole owner), 22 Quincy St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affidavit's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

E. S. FAUSSETT,
(Signature of Editor.)

Sworn to and subscribed before me, this 29th day of March, 1922.
[Seal.] Lillian E. Teich.
(My commission expires November 14, 1923.)

the shoulders for material and leaves the pavement in a dirty condition on cleaning. We believe that one of the best methods of cover is by the use of straw. Sufficient straw is supplied to cover about eighteen days work. The straw is spread on the finished pavement about three inches in thickness and thoroughly wetted down with a hose. When the proper period of curing has elapsed, the straw is moved ahead by hand-car to cover fresh work. In addition to being less expensive than earth cover, it has the advantage of holding the moisture longer and leaving the finished pavement in a clean condition when removed.

Joints. Again we have a considerable difference of opinion among Engineers relative to the use or non-use of joints. In Indiana all of our concrete pavements are being laid without joints, except at the end of a day's work or when the concrete work is stopped for any appreciable length of time, when a butt joint is used. This butt joint is formed by placing a template at the end of a day's run and inserting five three-quarter inch bars four feet long through the template for about two feet into the concrete. In the morning the template is removed, exposed ends of the bars are wrapped in paper and the concrete for the fresh section is tamped thoroughly around them. These bars prevent any vertical motion or riding of the slabs, at the same time allowing a chance for contraction. The elimination of joints gives a smoother pavement and cheapens the cost of construction. The only objection that can be made to the practice is the fact that a crack does not look quite as esthetic as a joint. If properly cared for, however, under maintenance, and filled with asphaltic cement, no bad results develop. A crack never rides, the joint does. It only remains for someone to invent an asphaltic cement of a color similar to that of the concrete pavemen titself, when cracks will be unnoticed.

There are some little points that the writer has picked up in his experience that seem to him to be of sufficient importance to mention in this article. One of them is longitudinal cracks and how they may be prevented. It is realized that again we may have a great difference of opinion on this subject. The writer believes, however, that longitudinal cracks are due to lack of uniformity of the subgrade. A subgrade that is unveenly compacted especially when an old road surface obtains through the center of the pavement and the shoulders are built up of fresh material, is liable to crack longitudinally. Many specifications provide that the subgrade shall be plowed to a depth of from ten to twelve inches and compacted again with the steam roller. I have even known of instances where the subgrade was plowed and very little compacting done and where no longitudinal cracks have developed. It is extremely important to have a properly drained and properly designed subgrade. Very careful consideration should be given to this phase of the work on any cement concrete pavement job.

Hill of Gravel 125 ft. High

The Sioux Falls Sand Company, of Sioux Falls, S. D., has a hill of gravel 125 feet high, and covering 25 acres. There is only about one foot of overburden, making the material very accessible.

The screening and washing plant is built at the bottom of the hill, and the material is brought to it by a Sauerman 1½-yard power scraper, operated by a 100 horsepower steam hoist. This discharges to a hopper which is built in a tunnel at the lower end of a 24-inch belt conveyor.

The material is then taken by the belt conveyor to the top of the plant from whence it discharges by means of chutes to a double battery of Gilbert screens. Gravel from ¼-inch to 1½-inch is screened out, and the sand passing the ¼-inch screen is washed by two automatic settling tanks.

A 5-inch American Well Works centrifugal pump delivers 600 gallons of water a minute to the wash house, obtaining it from a well 100 feet deep.

The entire plant is powered by steam, using a single 150 horsepower boiler.

The company owns siding with a capacity of 34 cars, switching to the Chicago, Milwaukee and St. Paul R. R.

Mr. Delbert Wheeler is manager of the concern, having formerly been connected with the Le Mars Gravel Company.

Why Prices of Cement Are Uniform

Competition, Not Collusion, Forces Bids to Same Level—Non-competitive Condition Would Quote Prices f. o. b. Mill to Disadvantage of Public.

In the March 2 issue of Engineering News-Record appears a letter from B. F. Affleck, president of the Universal Portland Cement Co., of Chicago, which has to do with prices lately made to Wisconsin Highway Commission. The letter follows:

There is no collusion. Such uniformity of prices as appears in the list of bids and elsewhere is due not to collusion, but to competition. Cement is a standard commodity conforming to a standard specification adopted by the government, the engineering profession, and cement manufacturers generally. There is no substantial variation in quality. It must all conform to standard specifications and is not required to exceed these specifications. The freight rates on cement, which is a large percentage of the value of the material, are matters of record. The railroads cannot vary them except on notice. The product, being one which is sold to many thousand dealers and consumers, is offered freely by the manufacturers at prices which are not secret, but which are given the widest possible publicity.

The material is made in a factory which the owner tries to operate continuously with perhaps some seasonal shutdown. He can determine in advance with fair accuracy his manufacturing costs and these do not vary widely except as wage rates and cost of fuel and material advance or decline. Therefore, changes in prices are, as a rule, infrequent. When prices change, most of the manufacturers notify by circular their customers and others whose business they desire at the new prices.

The conditions recited make it easy for any given manufacturer by simple arithmetic to ascertain the basis of quotations made by any other manufacturer. In fact, as the cement business is and must be conducted, it is quite impossible for any manufacturer to keep secret his policy with respect to prices. The price at a given destination is made based on a mill price, plus freight. It has been shown above that this mill price or basis quickly becomes a matter of common knowledge. The freight rate also is well known. Therefore it is easy to determine the delivered price. The material being a standard commodity throughout the country, it is practically impossible for any manufacturer to get more for his

product delivered at destination than any other manufacturer who can make the delivery is asking at the point of delivery. It is also not to be expected that a manufacturer, knowing what the market is at a given destination, will offer his product at less than that market. Where he to do so the strong probability is that the lower quotations made by him would soon establish itself as the market price and he would find himself obliged to sell all of his product at the lowered market price. And, of course, other manufacturers would also sell at his lowered price, which would quickly again become uniform as between all manufacturers quoting at the same destination.

It may be assumed that the public has no objection to uniformity of prices unless these prices are too high. If the cement manufacturers were to quote prices only at their mills instead of quoting delivered prices, the effect would be that at most destinations there would be only one brand of cement obtainable at the low price, prices on other brands from more remote mills being higher. This would clearly be a non-competitive condition which would not be to the advantage of the consuming public, but decidedly to its disadvantage.

In the case of Waukesha, listed in the table of bids referred to, the Universal company's bid was based on $1.60 at Buffington, the price in effect since Sept. 15, 1921, with 40 cts. for sacks, and 48 cts. per bbl. freight. This makes $2.48 delivered at Waukesha. Other cement companies, knowing what base price Universal had used since September 15, assumed that its bid at Waukesha would be $2.48 and they could not expect Waukesha business if they bid higher. Therefore the Lehigh and Alpha companies, whose mills are at La Salle, Ill., with a freight rate of 53 cts., shrunk the net at their mill to $1.55 to meet Universal competition and the Sandusky Cement Co. whose mill is at Dixon, Ill., with a freight rate of 51 cts., reduced the net price at its mill to $1.57 to meet Universal competition.

Block vs. Tile

One of the things which the American Concrete Institute had up for discussion at its convention in Cleveland is the relative status of concrete block and concrete building tile. There has developed a strong opposition to the adoption of new standards tentatively offered by the Institute's Committee P-1, Standard Concrete Building Units.

Stripped of all fine distinction and technical hair-splitting, the nub of the controversy appears to be just this:

Mr. Building Tile is a newcomer and wants to live under the law on the same street with Mr. Block. Mr. Block is a "climber," but hasn't got very high (usually not above cellar windows), and is afraid to associate in close accord with Mr. B. T., for fear it will be damaging to himself.

Joking aside: a concrete block is a good unit (when it is good), and so is a concrete tile. The block is heavy and will stand a bigger load (quality being equal) than a tile. Also, it takes more concrete to make a block, and two hands to lay it. A tile is thinner webbed, is usually picked up and set in place with the mason's one hand while the trowel is wielded uninterruptedly in the other.

A concrete tile has important work to do. It has a definite place. As a base for stucco, for curtain walls, for ordinary residence construction, for partitions, as a back-up unit, it has big possibilities. It has established itself in Detroit, Mich., for instance, against heavy odds. It will probably oust heavy common block in many of its present uses. If it does, it will be because it is better for the purpose. Face block will not feel that competition. It is in a different field. If it does nothing else, it will force the making of better block by driving it more and more into a new field. There is no reason why all concrete building units, no matter for what use, should be made to pass the same tests.

Then there is cinder block edging into the circle of dispute. It can't pass the absorption test, nor the strength test, which a unit for exterior facing or for heavy work should be obliged to pass. The chief value of cinder block is inherent in its inability to pass these tests. The cinder block is extremely porous. It's popcorn ball characteristics make it a good insulator. With a seal coat of waterproof stucco on the outside, it makes a good wall. It must be strong enough. To try to make it much stronger takes from rather than adds to its value.

This magazine has always stood for high standards. It still does. It believes that a standard high enough for unit designed for certain uses is too absurdly high for other units intended for other uses.

Let's draw our standards so as to get the economic value of all our assets in the field, not just part of them, at the expense and to the limitation of the others.—["Concrete," Detroit.]

Dunn Shovel Mixer

"The Structural Materials Laboratory of the Lewis Institute has conducted a test which conclusively proves the statement we have always made that concrete products made of Dunn Shovel Mixed concrete are stronger and of higher quality than other products. They have found by actual test that concrete mixed in a Dunn Shovel Mixer has an average of 24% greater crushing strength than that mixed in a well-known type of gravity mixer similar to the many others on the market. Details of this test will be gladly given you on request writes the W. E. Dunn Mfg. Co., 414 W. 24th street, Holland, Mich.

"Never before has it been so important to have your products of the highest quality than right now. No matter what kind of products you are making or how low you are selling them, you've got to depend upon quality to secure business and hold your trade. Just think what it means to you to be able to obtain at least 20% greater strength in your products without adding to their cost simply by using a Dunn Shovel Mixer. Don't wait until you are forced to use this mixer; install one now and get a jump ahead of your competitor.

"You've got to use power to drive your mixer. With a Dunn Shovel Mixer this same power can also be used to elevate your dry materials and automatically charge them into the mixer.

"Gravity costs absolutely nothing. With a Dunn Shovel Mixer you can use it to convey your mixed concrete directly to your production machines or wherever else you want it.

"This system whereby power and gravity are used to accomplish what is ordinarily done by hand labor is fully described in our Bulletin M21. Write for a copy."

House Walls

By Carroll Beale, C. E., Washington, D. C.

Editorial Note: Mr. Beale's extended experience in concrete construction entitles his views in this article to careful consideration.

Not the least interesting is the unusual and refreshing manner of presenting a subject which too often is classed among the dry-as-dust technical matters.

It seems strange that in the development of all the mechanical arts the least progress has been made in the thing that we should be most vitally interested in, and that is in the construction of our homes. We now have sanitary plumbing, gas and electric lights, stoves, mechanical elevators, steam and hot water heat, and a thousand and one things that go towards making life more comfortable; and yet in the actual construction of our buildings—and by construction is meant the outer shells or walls, floors, partitions, etc.—there has been but little change. Brick walls are laid today in the same manner, with the same tools, with the same mortar and with approximately the same brick as were used in the time of King Solomon. The brick mason's trowel today is precisely the same as that which made Solomon's Temple an actuality. This is hard to realize, but is true. King Solomon, if history be correct, was a pretty wise old fellow, but nobody ever said, as far as I know, that he invented the mason's trowel, but the fact remains that whoever did invent it made a permanent job of it and fixed it so that it couldn't be improved upon, or that there has been a woeful lack of thought given the matter by those employing its use. In any event, a brick wall today is the same as a brick wall five thousand years ago, and it looks as though this will ever be the case so long as a brick wall is used.

Rubble Stone Walls

There has been no more improvement in the construction of rubble stone walls than there has been in brick walls. They are laid now as always. Rubble masonry walls owe their popularity perhaps more to their architectural possibilities and economy of construction rather than to any structural or insulating advantages they possess. Then, too, a rubble wall, due to the difficulty of properly bonding the same, is necessarily much thicker than is a brick wall, and while the material per unit of volume is usually less expensive than brick, at least 50 per cent more material is necessary to secure the same stability; so, figuring the wall per square foot of surface, the only way walls should be figured in order to make the proper comparisons, a rubble stone wall will cost about the same as brick wall.

Rubble stone walls are necessarily too thick for the construction of buildings in the city, where space counts, and their field may be truly said to be limited to foundations and buildings of moderate height in the country, for which purposes rubble masonry walls have many possibilities.

Regarding the thermal conductivity or insulating value of a hollow tile wall, I might state first and foremost that a hollow tile wall is not hollow. It is only hollow in spots. The webs of the tile and the central wall of the tile run through the wall from front to inside, and as far as insulation goes, at these points there isn't any.

Conductivity of Walls

To any student of radiation of heat and the thermal conductivity or insulating values of materials, it is well known that the only perfect insulator is a honeycombed mass, a mass containing countless small voids, such as provided by nature by the wool of a sheep, hair on a dog, or feathers on a chicken. These are the perfect insulators. Heat radiates by jumping across a void from one point of contact to another, and every time it jumps it loses so much of its potential energy, and if it jumps often enough soon dissipates itself. This is exactly what happens to heat or cold in passing through a honeycombed mass. Heat or cold radiate much quicker jumping across one hollow space, as in the case of a hollow tile, than it does jumping across countless little ones and losing each jump some of its energy.

Concrete walls properly constructed are several inches thick, and made of rich concrete poured in a wet state and containing a minimum of voids.

As an example of what can be done towards making concrete walls impervious to water, look at a concrete ship, having a wall less than four inches thick, twenty-four feet below the level of the sea. The inside of these ships' bottoms were dry. The concrete was very rich, consisting of a mixture of one part of cement to two parts aggregate. There was no waterproofing in the concrete other than the painting on the outside. One of the reasons for the prejudice against concrete walls on account of dampness is due to a confusion of ideas as to what dampness really is. Ask the average architect what he considers the dryest and best basement wall known, and he will invariably tell you a concrete wall, yet this wall may be in wet ground with several feet of water standing against it. Yet for walls above the ground, this same architect will select a brick wall or any other kind of wall in preference to a concrete wall.

Dampness Generally Condensation

Surely a wall impervious to water below ground is impervious to water above ground, and it is a wonder to me that the people in general, and the architects in particular, don't realize that what they usually term dampness in a concrete wall is condensation, which forms on any dense material, due to the difference in temperature on opposite side of the wall. When it is warm within the building and cold without, this condensation will form, and the denser the material the greater the conductivity.

To get an idea as to just what happens in a concrete wall, consider a glass of ice water on a warm day. The outside of the glass is wet. Now the water did not go through the glass, of course, so what really happened was this: It being cold on one side of the glass and warm on the other, the atmosphere condensed and caused the moisture on the outside of the glass. This is exactly what happens to a concrete wall.

(The author, of course, considers it understood that the above action would take place if no insulation was provided in the wall or upon it as in furring and lathing—Editor.)

Automatic Motor Starters

For use in industrial plants, a valuable development has been the introduction by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. of automatic starters for synchronous motors. These motors can now be started as easily as an induction motor, so that the only starting operation required by the attendant is the operation of a push button.

Westinghouse engineers have also demonstrated the feasibility of arc welding alloy steels. With adequate mechanical and heat treatment, tensile strengths of the weld of the order of 130,000 lb. per square inch have been secured.

Atmospheric Conditions Hasten Initial Set of Cement

Standard Physical Test Fails to Detect Sub-normal Initial Setting Time Disclosed by "Hot Water and Warm Closet" Test

By C. L. Jenken, Construction Engineer, Maricopa County Highway Commission, Phoenix, Ariz.

During the warm summer months it has been noted on the highway construction work under way in Maricopa County, Ariz., that often the fresh concrete would take its initial set in the pavement so rapidly that within 30 minutes after mixing, belting of the surface was almost impossible. This condition, which occurred with the use of cement that had passed tests made most carefully according to standard methods, was studied until a means was developed for detecting cement having such characteristics. This is now accomplished by mixing the test samples of cement with water after both water and cement have been warmed to a temperature of 100 deg. F., and, in order to approximate in the laboratory the conditions that obtain in the field, keeping the samples at this same temperature in a damp closet until the initial set has taken place.

After a series of tests made on the job and in the laboratories of the cement manufacturers in California, and checked by other laboratories, it was conclusively shown that cements would take their initial set in one or two hours less time in Phoenix than in Southern California. This difference was believed to be due to the arid climatic conditions in Phoenix, which is noted for the low atmospheric humidity and high temperatures between June 15 and Sept. 10. The accompanying table giving data of two winter months and two summer months shows the extraordinary dryness and

Typical Climatic Conditions, Phoenix, Arizona

	Mean Temp., Degrees F.		Precipitation, Inches	Evaporation, Inches	Wind		Relative Humidity, per cent	
	Maximum	Minimum			Movement, Total Miles	Avg. Hourly Velocity	Morning Observ.	Evening Observ.
January	66.5	37.5	0.13	3.069	3,315	4.5	67	35
February ...	73.3	42.0	0.11	5.122	3,639	5.4	58	24
June	101.4	68.2	0.04	12.822	3,761	5.2	34	14
July	101.3	77.1	0.38	12.081	4,634	6.2	59	32

other climatic characteristics of the locality where the Maricopa County highway work is under way.

It appeared therefore that some method other than standard physical test must be developed to detect cement that would take its initial set in the pavement too quickly to permit of its being properly handled. After some experiment such a method of testing has been developed, which has proved very satisfactory. The method of carrying out these tests is as follows.

After the regular standard physical test has been made, a second test of initial set only is made from the cement sample. First, the dry cement is warmed to a temperature of 100 deg. F., or very nearly, then mixed with a mixing water of the same temperature. This usually required from 1 to 3 per cent more mixing water to obtain normal consistency, and a much more vigorous kneading than the standard test to thoroughly mix the paste. Two test pieces are made from this paste, one in the standard hard rubber ring for the Vicat needle and one standard pat for the Gilmore needle. These are run in duplicate for the purpose of a check. The test pieces thus made are stored in a moist closet which is kept at a temperature between 90 and 100 deg. F. until the initial set takes place.

The accompanying table showing the result of initial set tests under different temperatures, clearly shows the effect of temperature. Tests A, B and C were made from the same sample of cement. Test A being the result of the standard test, which gave an initial set of 2 hours and 1 minute. Test B was made under a higher temperature and in this case set in less time than the standard test. This temperature, however, does not consistently cause set in less time and is not dependable. Test C was made in accordance with the above described method and in this particular case set in 49 minutes. This same cement was observed in the field while being placed in the pavement and was found to set in about the same length of time. About 1 hour for the initial set under this method was found to be about the minimum length of time to work properly in the field. Cement which took an initial set, in this test, in less than one hour, especially on extremely warm or warm and windy days, invariably set too soon to allow the proper belting of the finished road surface.

Test	Laboratory Atmos. Temp., Deg. F.	Dry Cement Temp., Deg. F.	Mixing Water Temp., Deg. F.	Normal Consistency, per cent.	Initial Set — Vicat	Initial Set — Gilmore	24 Hr. Pat, 5 Hr. in Steam	Moist Closet Temp., Deg. F.
A	76	78	78	23½	1 hr. 26 min.	2 hrs. 1 min.	O. K.	76
B	96	80	78	24	1 hr. 6 min.	1 hr. 47 min.	O. K.	80
C	96	100	100	26	31 min.	49 min.	Slightly soft	96

This seems to prove conclusively the contention previously made that the extreme dryness and high temperature is responsible for this peculiar behavior of the cement. With the aid of the manufacturers' cooperation and through their effort to furnish a slow setting cement this difficulty has been almost entirely eliminated.

"Bungalow Homes"

"Bungalow Homes," 143 pp., 6¾x10¼, paper, $1.50. To quote the editors of this book, it contains "actual photos and reduced blue print floor plans critically selected from thousands of houses we have inspected in more than ten states." The bungalows are simply designed, compact, with especial attention paid to ventilation and window lighting. They all have full cemented basements, and open-air sleeping porches. Built in features are part of the designs. There are a number of four-room styles shown, though the preference seems to be for five-room types; and there are numerous two-story designs of simple and dignified appearance. In fact, as the preface states, there are designs of simple and dignified appearance. Approximate costs will be given upon request, and full blue print working drawings may be obtained, consisting of four elevations, basement and floor plans, all drawn to the scale of ¼ inch to the foot, with details of cabinets, buffets, mantels, bookcases, etc. A sectional drawing and roof plan are supplied where any intricacy of construction would seem to warrant it. The specifications are made to cover every step from the excavation to the completion of the building. Changes in plans will be made at a nominal cost. Both book and plans are to be obtained from L. F. Garlinghouse, Topeka, Kans.

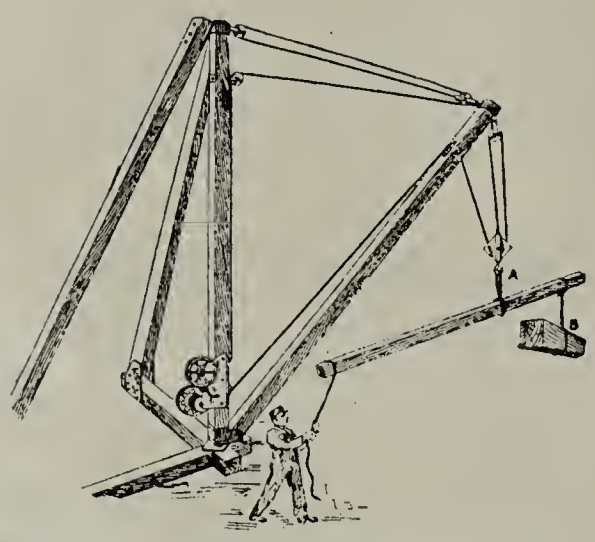
Fertilizer Plants

The Sturtevant Mill Co., Harrison Square, Boston, Mass., has recently issued a beautiful 96-page cloth-bound catalog, "The Modern Fertilizer Plant." The typography is of the best and the halftone engravings and the drawings, printed on heavy coated paper, are very attractive. The book contains the story of the Sturtevant company's 39 years of development of fertilizer machinery. A 36½x22½-in. drawing showing a complete fertilizer plant is inserted at the back of the book and a detailed description of the plant units is given. Several pages are devoted to general information valuable to the fertilizer manufacturer contributed by Dr. Samuel W. Wiley, president and general manager of Wiley & Co., Inc., Baltimore, Md., one of the leading fertilizer chemists, and operating a laboratory in that city.

Extending Reach of a Derrick Boom

The reach of a derrick boom determines its radius of action. This radius can be increased by a simple expedient so that material can be handled in corners that would otherwise be difficult to reach. Steel or other material can also be shifted and put into place more readily by its use than by raising and lowering the main boom.

The device consists of a timber, usually a spare derrick boom, *A*, about which a sling is placed in such position as to almost balance the load, *B*. The overbalance



Simple device for extending the length of a boom derrick's reach

is left on the free end of boom *A*, to which a rope is attached. When the load *B* is approximately in position, it may be easily maneuvered into place by pulling down on the rope to elevate it and from side to side to shift to position. Too great an overbalance on the free end of boom *A* would make the arrangement awkward to handle. The circle swing counterweight derrick, manufactured by the Sasgen Derrick Co., 3117 W. Grand ave., Chicago, cuts costs, labor and time loading or unloading material from cars or wagons. The new Sasgen catalog describes not only this derrick but a size or style for every class of work.

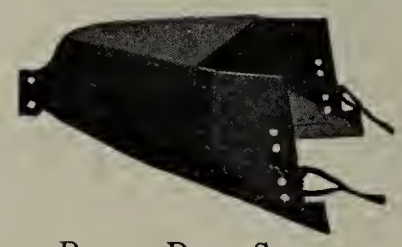
Drill Sharpeners—Air Compressors

Several interesting bulletins have recently been issued by the Sullivan Machinery Company, 418 Gas Building, Chicago, Ill. Bulletin 72-E describes and illustrates the Sullivan drill sharpeners for hammer forging drill bits and shanks, including the new Class B light weight drill sharpeners as well as the standard Class A machines, with special reference to the making of genuine double taper bits, etc. Bulletin 77-A illustrates and describes the mine car portable air compressors of this make, which are operated by electric motors for use in rock removal underground and particularly in coal mines. Pictures displaying the compressors in actual use in mines are pre-angle-compound power driven air compressors and includes mention of the single or duplex machines for low pressure. Sundry pictures of installations are in this bulletin.

Power Drag Scraper

The latest developed Power Drag Scraper for use in sand and gravel plants, manufactured by L. P. Green, 907 Lumber Exchange bldg., Chicago, is proving its merit over any scraper he has sold in the past, and he sells it with the guarantee that if for any reason whatever you are not satisfied with it after reasonable trial you may return it and receive full credit for the amount charged for it.

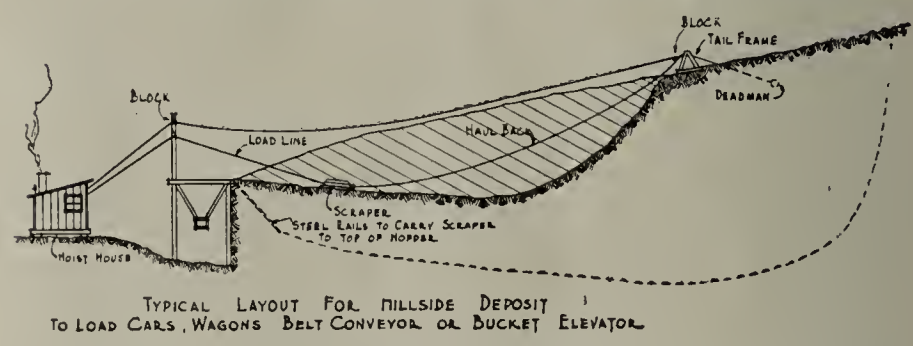
In backing up his guarantee he stands ready to send a competent man to assist you in deciding the size of



Power Drag Scraper

equipment and method of operation for your job; also to assist at any time your job is not working satisfactorily, as he is of the opinion that it is just as important to have your job successful as it is to sell you, as every successful job sells at least one scraper for him.

If you are interested write for prices and any further information you want. If you want Mr. Green's



TYPICAL LAYOUT FOR HILLSIDE DEPOSIT TO LOAD CARS, WAGONS BELT CONVEYOR OR BUCKET ELEVATOR

recommendation for suitable size and method of operation for your job give as much information as possible in your first letter. If you have a hoist state size of cylinders or horse power.

L. P. Green has sold over sixty power scrapers during the last two years, all of which are in successful operation, scattered pretty well over the different states. In Wisconsin where the scraper is better known he has thirty to date; five in 1920 and twenty-five so far in 1921.

Handy Sack Baler

The record of the Handy Sack Baler Co., 620 S. Second street, Cedar Rapids, Ia., during the past few years has been one of steady progress. They have recently added fifty per cent to its manufacturing space and thereby relieved a congestion that has been a drawback for several years. With working quarters greatly enlarged, the company is now prepared to keep up with the demand for their sack balers and cement bag cleaning machines. Contractors, dealers and concrete products manufacturers who use the Handy Sack Baler, save cement and sack loss. The machine is simple and inexpensive and it bales the sacks up tight and securely. Thousands of them are in use all over the country.

Catalog on Type K Engines

The Anderson Foundry & Machine Company, of Anderson, Indiana, are giving to the trade in their new Bulletin No. 23 a treatise on oil engines which will prove interesting to pit and quarry operators. The book begins with a description in a very general way, of the principal Anderson features, and then takes up, under the heading of "Main Points for Consideration," the particular features of the Type K engine, one by one. In all there are thirty-two sections, each devoted to some particular part of the engine. The text is very carefully written, and well illustrated with photograph and line drawings.

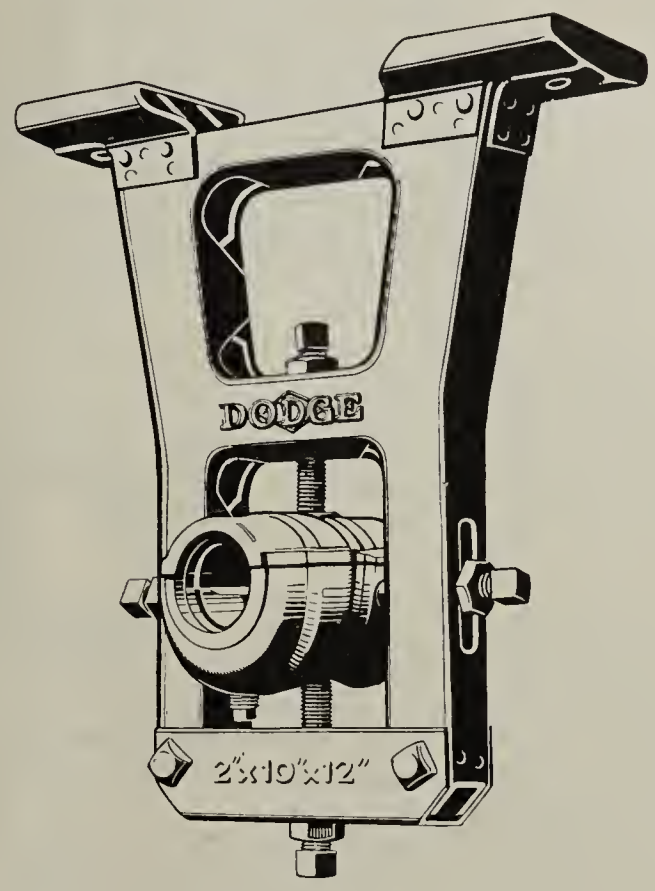
One of the principal features of the Anderson Type K engine is the fact that it is equipped with two fly wheels, which are symmetrically designed and correctly proportioned to insure steady operation.

Car Unloaders

The Jeffrey Mfg. Co., 914 North Fourth street, Columbus, Ohio, has issued Bulletin No. 360, featuring the Jeffrey portable car unloader. It is so constructed as to require a minimum of space in which to operate and can readily be placed in between the car hopper door and the rails. Where conditions permit, a more permanent arrangement can be had by placing the unloader underneath the rails and thus eliminate the necessity of resetting it for each car.

Pressed Steel Hanger

The Dodge Sales & Engineering Company of Mishawaka, Ind., announce the yhave perfected, after two years' experimentation in construction and design, a pressed steel hanger for general-purpose use.



The Dodge Pressed Steel Hanger represents the most advanced development in general-purpose hanger construction under conditions which permit its use and where extreme vibration is not a factor.

In offering to power transmission users the pressed steel hanger, the Dodge organization does unreservedly endorse steel hangers, regardless of their construction for every purpose, but they simply recognize a demand for a lineshaft hanger of lightness and strength to serve under conditions not severe or unusual and where first cost is of guiding importance.

The Dodge Pressed Steel Hanger is now available through Dodge, Oneida and Keystone dealers on an immediate delivery basis.

Showing Jeffrey Portable Car Unloader delivering coal to storage pile by means of a separate Jeffrey Portable Belt Conveyor

News of the Cement Mills

A deal was closed last month whereby the New Egyptian Portland Cement company, Fenton, Mich., assumed a long-term lease of the former Grank Trunk steel car shops, which have been idle for some time. The plant will be remodeled for the manufacture of cement. The company also has a lease of 1,200 feet of river frontage and will be able to unload calcite from boats into the plant with one operation and to load cement the same way for water transportation.

The Giant Portland Cement Co. reports for the year ended December 31, last, gross receipts of $2,070,673, net operating earnings $287,452, bond interest paid and accrued to December 31, $27,750, net profit for year $149,365, balance transferred to surplus after preferred dividend, etc., $43,123.

The banner year of their organization was the verdict of salesmen of the Sandusky Cement Co., at a banquet at Hotel Cleveland last month, following the reading of the company's financial report for 1921 by William B. Newberry, assistant general manager. He also stressed the unlimited possibilities for American trade in South America.

The banquet brought to a close the annual two-day conference of the sales force, which was held in the Company's main office in the Engineers' building, Ontario street and St. Clair avenue.

The plan for the consolidation of the Cement Securities Company, Denver, and the Alpha Portland Cement Company, Easton, Pa., which has been in contemplation for a year, has been abandoned, according to a letter to stockholders of the former corporation, signed by Charles Boettcher, president of the company, and chairman of the committee on consolidation. Under the plan proposed, the agreement of deposit of the stocks of the two companies provided that unless the plan were declared operative within a year after its original date, it should be considered as having been abandoned.

In his letter Mr. Boettcher says:

"The situation outlined in a letter sent to the stockholders of the Cement Securities company, under date of March 31, 1921, has not yet developed to a point where such conclusions may be drawn as to justify the committee in effecting the proposed consolidation. From the standpoint of the Cement Securities company it would also be obviously undesirable to becloud the issues involved in the dissolution proceedings recently instituted in the United States district court at Denver by a consolidation at this time with any other company. In this connection, however, it is appropriate to repeat the statement contained in the letter of March 31, 1921, that the officers of this company are confident that the final outcome of these legal proceedings will be a complete vindication in all matters upon which the charges are based.

"In view, therefore, of the expiration of the consolidation agreement by its own terms, and on account of the general situation outlined above, the committee has instructed the Denver National bank, depositary, to deliver to holders of deposit certificates, upon surrender of the same, the shares of stock of the Cement Securities Company represented thereby, and all negotiations for a consolidation under the plan and agreement of January 14, 1921, have been definitely terminated."

At the annual meeting of the Cement Securities Company, held recently, the following directors were elected: Charles Boettcher, Claude K. Boettcher, Harry C. James, James Q. Newton, John H. Porter, M. D. Thatcher and R. J. Morse.

The new board organized by electing the following officers: President, Charles Boettcher, vice presidents, Claude K. Boettcher, Harry C. James, and R. J. Morse; treasurer, Harry C. James; secretary, R. J. Morse; assistant secretary, Carrie H. Morse.

Mr. J. L. Goffette, 1631 Yew St., Vancouver, B. C., writes as follows: "Two years ago I made tests for a cement company. The president, who was assisting at the demonstration, was delighted with the results and asked me to make for him ten sacks of my quick setting cement to be tested by several cement experts. I agreed to make 100 sacks of cement for him on condition that if the tests were satisfactory he would manufacture this material and pay me for my process. He consented to this and it was agreed that a contract to protect my interests be drawn up in due form. He had his attorney draw up a contract, but if I had signed that document I would have been robbed of my process and I refused to sign.

Would like help from reliable parties to put my process on the market.

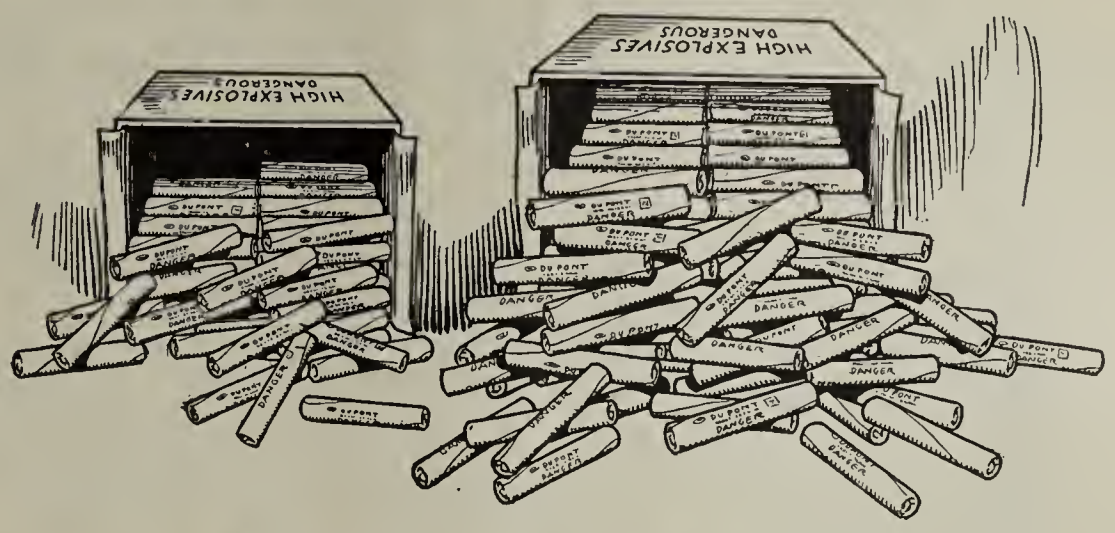
The cement mill at Alsen, N. Y., formerly owned by the Alsen Cement Co. of America, is now known as the Hudson Valley Portland Cement Corp. The new owners are putting in a wet process. Ellis Soper is in charge of the work as general manager. Mr. C. L. Carman, c/o Heidleberg Inn, Catskill, N. Y., formerly consulting engineer for the Riverside Cement Co., Riverside, Calif., and who designed and built the Riverside plant and installed the Cottrell dust collecting system, is connected with Mr. Soper in improving and modernizing the Alsen plant.

Cape Girardeau Portland Cement Co., Chas. L. Harrison, president., Cape Girardeau, Mo., is remodeling their plant which includes installation of boilers, costing about $110,000; additional $20,000 turbine, grinding machinery, etc., to produce daily 2,400 barrels cement or 9,600 sacks; later plans erecting administration building of concrete construction, estimated cost $25,000; lay all wires underground, in order to beautify grounds.

O. V. Webster, about 35 years old, a laborer, probably was fatally injured and three other workmen suffered minor injuries last month when a raw material tank at the Western States Portland Cement company plant blew up.

The accident occurred when a quantity of accumulated gas in one of the three new raw material tanks exploded. The concrete tanks are just being erected. The tank proper is about twenty feet in height, standing about eight feet off the ground.

1/3 more per dollar



THE DU PONT COMPANY leads the way in the production of more efficient and more economical explosives. In Dumorite, its latest achievement, it has made possible

a great step in the reduction of explosive costs

Dumorite is a new money-saving dynamite which gives you over 1/3 more work for your dollar—a guncotton-nitroglycerin dynamite without a headache—a non-freezing dynamite which can be used successfully at any temperature.

Dumorite has approximately the same strength as 40% dynamite and does the same work, stick for stick. And you can buy 135 to 140 sticks of Dumorite at the same price as 100 sticks of 40%.

Ask the Du Pont Explosives Service Department through our nearest branch office how Dumorite can be used in your work. Ask that question in a letter outlining your requirements. Find out how this new development in explosives manufacture can cut your blasting costs for 1922.

Branch Offices:
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Huntington, W. Va.
Kansas City, Mo.
New York, N. Y.
Pittsburgh, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
Springfield, Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department, Sales Division
Wilmington, Delaware

NON-HEADACHE DU PONT NON-FREEZING
DUMORITE

News of the Concrete Products Factories

Steam cured concrete brick manufactured by St. Paul Cement Works, 34 East Fourth St., St. Paul, Minn., has given excellent service and although a comparatively new product in the Northwest is steadily gaining in favor. All types of ornamental concrete products are produced by this company and many of them are illustrated in their new catalog. Burial vaults and sanitary septic tanks complete the long line of quality products.

The example furnished by the St. Paul Cement Works in preparing this attractive and instructive catalog is one that should be emulated by other concrete products manufacturers. The public is eager to learn of any material that can be economically used in the construction of homes. Its interest can be aroused by a concise presentation of the merits of quality concrete products. An illustrated catalog is an excellent medium for their presentation. Prosperity does not seek out the man who hides his light under a bushel.

Mr. A. P. Nelson, Spencer, Iowa, started out about seven years ago with one Hobbs machine and tamping by hand. As the demand for his products increased he first added an Anchor Automatic Tamper to his one machine. As the demand grew he added more units to his battery until he now has a battery of ten, each producing 500 blocks per day with one man on each machine.

A battery of small units which are efficient and yet not so complicated that they get out of order is a far more practical and cheaper means of producing a large output than the use of large expensive all automatic machines. If you will investigate the concrete block machinery now on the market you will find that Mr. Nelson with his battery of Hobbs and Anchor machines is getting more blocks per man per day than can be gotten in any other way. Furthermore, a breakage of any one machine does not mean a costly shutdown of the plant because the man operating the machine which goes wrong is immediately shifted to a spare machine while the faulty machine is repaired. In this way no time is lost and the accident to the machinery does not prove costly.

The Waterloo Playford Silo Co., Waterloo, Ia., operate New Monarch stave silo molds and are doing a very large business. They advise us they have taken on territory for the manufacture of Granette monuments, markers, vases, etc.

So great has been the demand for cement blocks, that the B. B. Cement Stone Co. have found it necessary to operate another factory. The new plant will be located at 2126 S. Main St., Wichita, Kans.

Tests of Duntile, a hollow concrete building unit made on a Dunn machine, are reported by the Structural Materials Research Laboratory for two sizes of tile, 4 in. square by 12 in. long, having a 3-in. circular hole for the length of the tile, giving a wall thickness of .55 in. Three of these tile were tested. They stood an average load over the gross area of the tile of 780 lbs. per sq. in., or 2,830 lbs. per sq. in. for the net area alone, and had an average absorption of 6.9.

Tests on two large Duntile, 6 in. by 6 in. by 12 in., with a wall thickness of 1.05 in., gave 970 and 790 lbs. per sq. in. gross area and 2,780 and 2,270 net area. These tile were not tested for absorption.

In the manufacture of concrete trimstone in the plant of the Architectural Decorating Co., 1600 S. Jefferson St., Chicago, there are several types of molds used. Ordinary plain pieces slightly ornamented with simple beading or molding such as door jambs, door heads and similar features, are cast in wooden molds that are made directly from the architects' drawings. In the manufacture of complicated or more ornamented designs such as consoles, friezes, cornices and similar pieces where there is no ornamentation that is under cut, plaster molds are used. Plaster molds are usually made with wooden backings and the mold is fashioned in the face of the plain plaster cast. In manufacturing all exceptionally ornate or intricate pieces where under cut details exist, glue of gelatin molds are employed. The piece to be cast is first modeled in clay. The clay model is then given two or three coats of shellac to protect it from injury while the glue mold is being cast.

In general the process of manufacturing a glue mold for concrete cast units is as follows: The clay model is covered with a thin layer of paper. Upon this paper there is placed a coating of clay which roughly follows the outline of the model and is at no place thinner than ½-in., although in places where the model is deeply under cut it may be 4 or 5 ins. thick. After the application of the coating of clay a wooden casing is placed about the model and filled with plaster. After the plaster has set this casing is removed, the clay coat and paper removed from the face of the model and holes drilled in the plaster coat to permit pouring the glue or gelatin and also to permit the escape of air while this is being done. After these holes have been drilled the casing is applied to the model exactly in the position it occupied when it was first formed. Glue is then poured through a funnel and into the space formerly occupied by the clay coating and the paper covering. The air vents must be drilled with extreme care so that when the glue is introduced there will be no air trapped within the mold. If this should occur it will either cause the mold to burst as the air expands due to the sudden rise in temperature or else it will cause a hole or pocket in the face of the glue and render the mold worthless. As the hot glue rises in the mold the air vents are stopped with plaster or clay to prevent glue flowing from the casing.

After the glue has cooled sufficiently to become firm the mold may be removed. It is then coated with two or three coats of white lead and when the paint has dried the mold is carefully oiled or greased to permit its easy removal from the concrete.

Concrete (a 1:3 mix, proportioning of which is a secret formula obtained by many careful experiments) is poured in the glue mold and when it has acquired its initial set the mold may be removed. The flexibility of the gelatin or glue permits this type of mold to be drawn from the face of the concrete without damaging the casting even though there are numerous heavy under cuts in the design.

Saving Overhead Underground

There's only one way to get hose economy here — buy the best hose made for the job.

Goodrich qualifies 100 per cent and usage will prove it. The cover is extra thick and extra durable—it stands up better against abrasion from dragging, yanking and pulsation.

Falling rock cannot permanently distort or weaken the hose. It springs right back into shape when debris is removed. It won't kink or crack at the couplings.

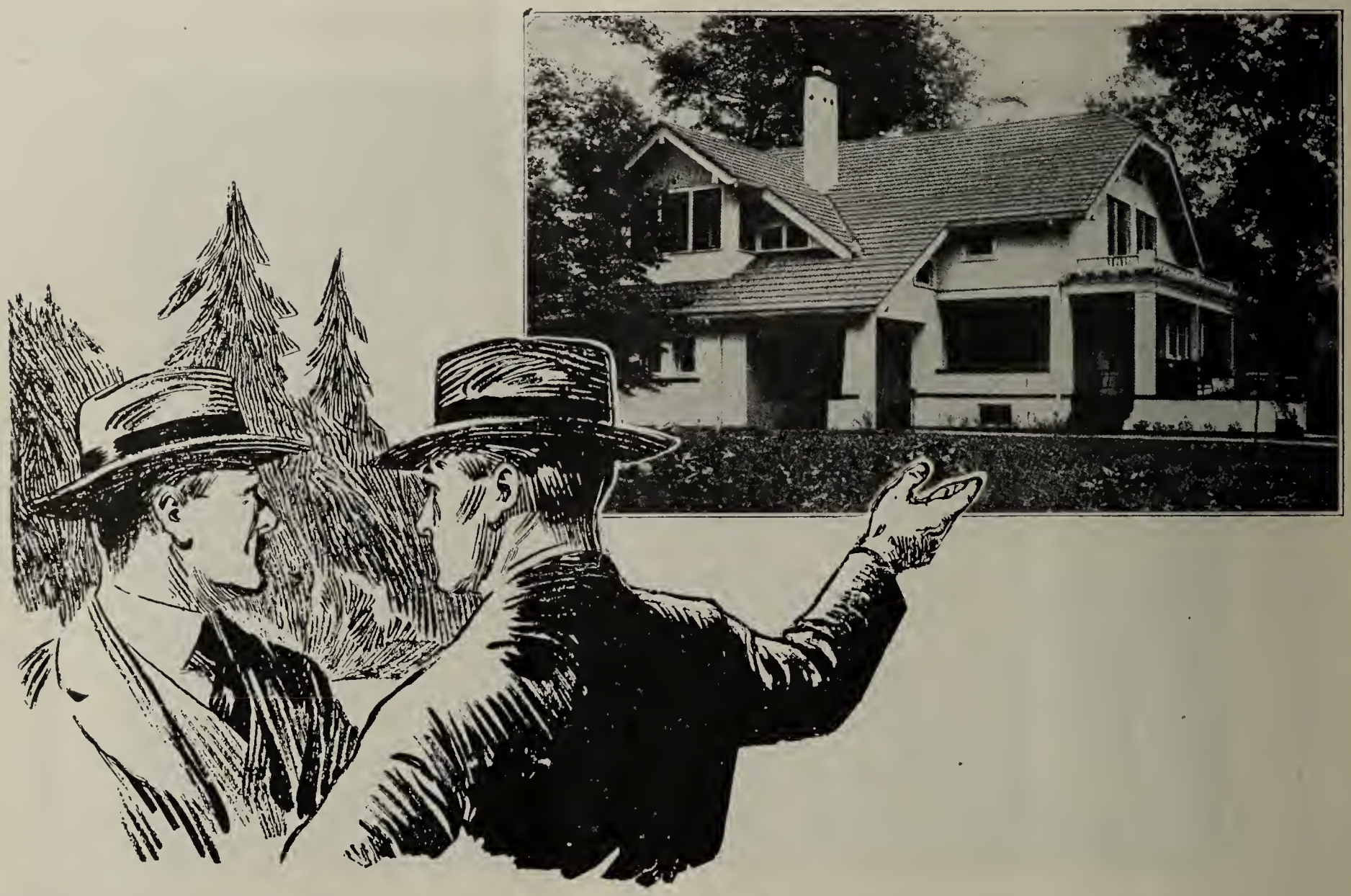
The oil spray carried into the hose from the compressor means nothing to Goodrich Air Drill Hose. The tube has been specially compounded to defy it. Remains non-porous and full of vitality.

The maxim this year is "Cut down expenses"—here's one way to do it underground.

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

Goodrich

AIR DRILL HOSE



MAKE EVERY ROOFING JOB A BUSINESS GETTER

That means every customer, an enthusiastic booster—every roof you lay, an effective salesmen.

Concrete roofing tile made on an All Automatic Roofing Tile Machine are best advertised by their owners. That's why many builders now use and recommend them exclusively. They know the business such advertising creates.

Concrete roofing tile made on our machines offer a complete roofing service. They are used on the mansion and the cottage—for the barn and the hen house.

All Automatic Concrete Roofing Tile, for sheer architectural beauty, are unsurpassed. They are furnished in two colors—rich warm red and cool sage green.

The All Automatic Hand Machines will produce all the required straight and special pieces for any roof. They require no skilled labor and manufacture 900 straight tile or 300 finishing tile a day. Easy and rapid in operation and the only machines which produce a line of tile where joints can be broken.

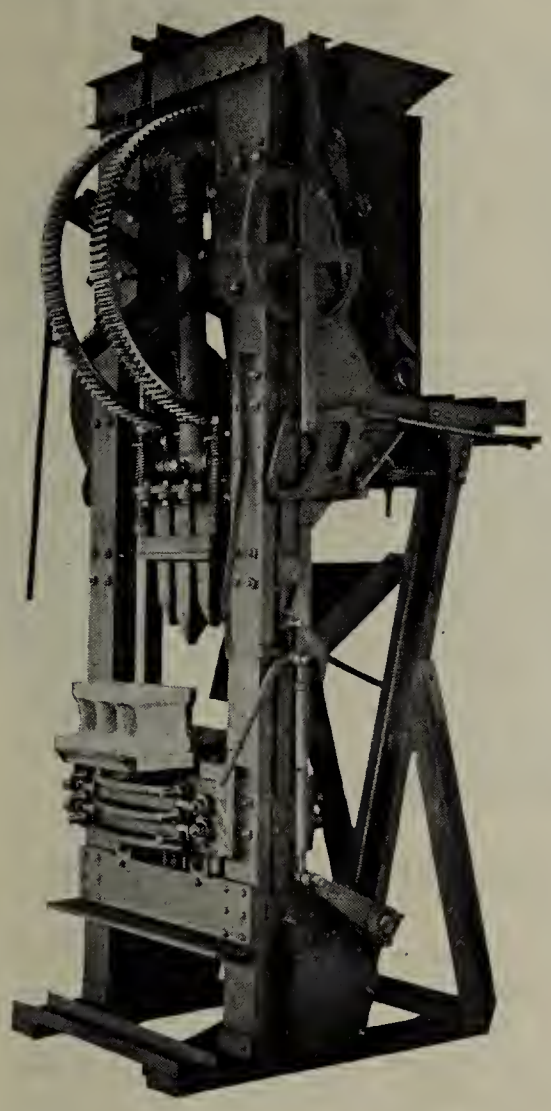
The popularity of roofing tile is constantly growing. Get in on the building boom with a quality popular product for new and re-roofing work.

Complete plants consisting of forms, machines, pallets and moulds, $1,200.00. We help you get started.

ALL AUTOMATIC MACHINE COMPANY

1740 EAST 12TH ST. Suite 590 CLEVELAND, OHIO

ATTAINING THE MAXIMUM IN OUTPUT AND ECONOMY



FINALLY NARROWS DOWN TO THE ADAPTION OF THE

Post Economy Punch Block Machine

for large production of quality concrete blocks. It is an automatic machine.

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block.

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

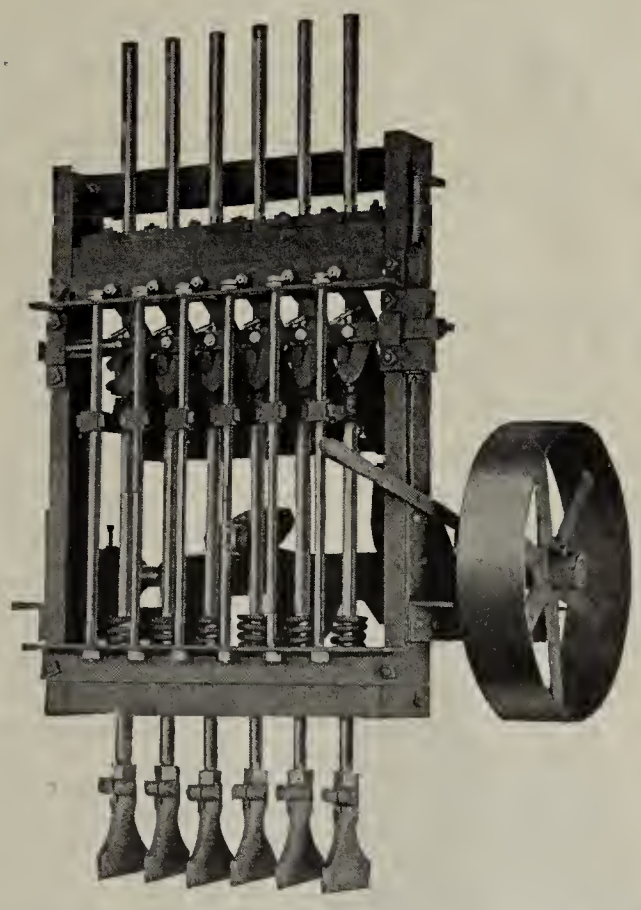
The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.

A Reliable Tamper for the Small Concrete Block Plant

The Kent reliable tamper has a shock absorber on each lifting foot, reducing noise of the lifting blow. It is substantial in design and is guaranteed against breakages due to workmanship and material. It will fit over any block machine.

The machine will not knock itself to pieces as other tampers do. The individual shock absorber looks after that. Long bearings, rugged steel frame, heavy castings, stiff shafting, turned pulleys, means small repair bills.

We are now placing on the market the following machines, to be known as the



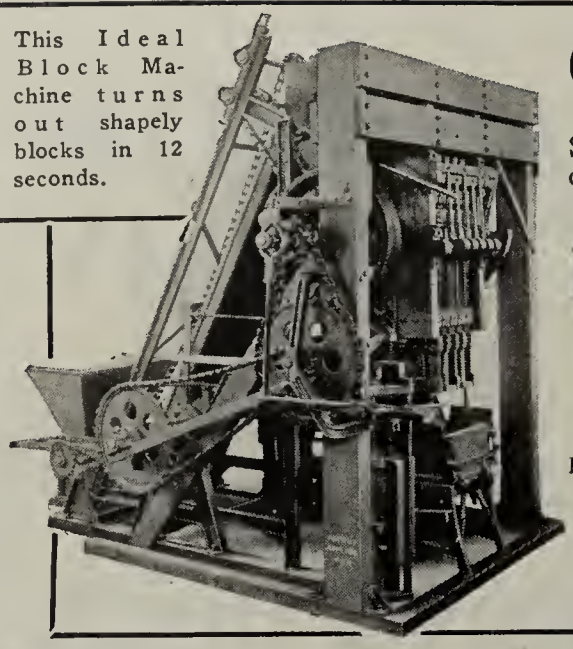
RED LINE PRODUCTS

Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

KENT, OHIO

This Ideal Block Machine turns out shapely blocks in 12 seconds.



Get In Line Now!

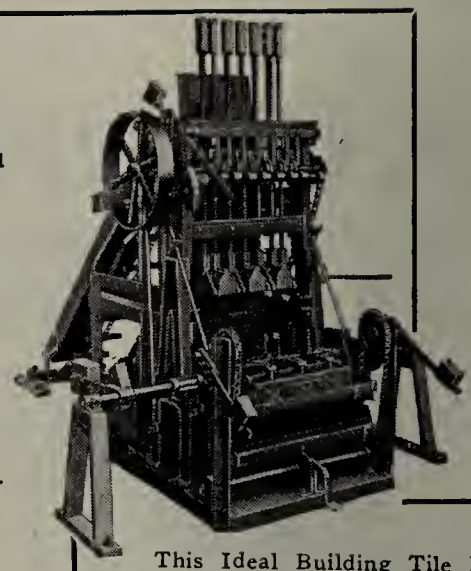
Spring building operations are opening up. You can top the field with

Ideal Automatic Concrete Block Machines

***And* Fully-Automatic Building Tile Machines**

Modern, high-grade, strong and serviceable equipment. Write us today for complete information.

The Ideal Concrete Machinery Co.
1338 MONMOUTH STREET CINCINNATI, OHIO



This Ideal Building Tile Machine strips 3 tile onto one wooden pallet.

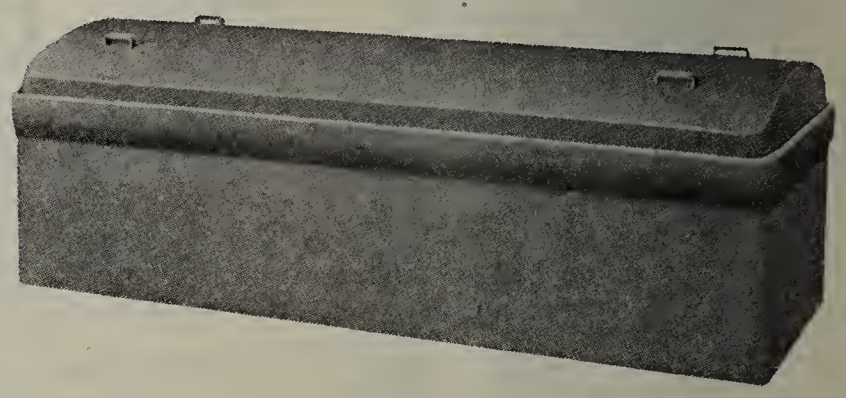
A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.



Another Field Open for Cement Products Manufacturers

To be truly sanitary and airtight, concrete burial vaults must be made permanently impervious to moisture and dampness. Tests conducted under severe conditions and covering long periods of time have definitely proven that **Medusa Waterproofing** adds the necessary dampproof qualities needed and opens another profitable field for local cement-products manufacturers.

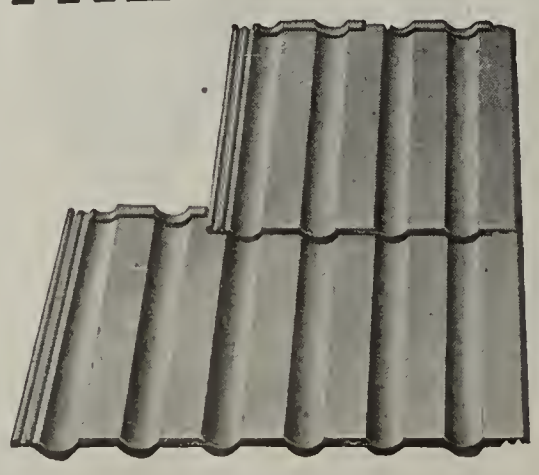
Medusa Waterproofing is sold separately or already added to Medusa Waterproofed Cement.

Write for particulars and name of nearby "Medusa" dealer.

THE SANDUSKY CEMENT COMPANY
Department E Cleveland, Ohio

MEDUSA Stainless White Cement

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

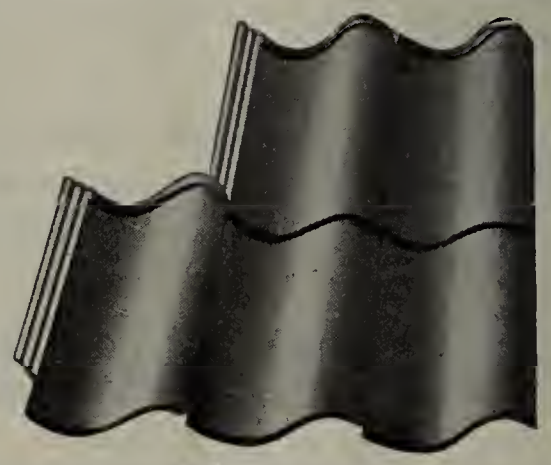
An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name: "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.
3617 E. 23rd Street Kansas City, Mo.



SPANISH TILE

KOEHRING

HEAVY DUTY MIXER

THE **surest-profit** factor you can bring on a job—mixer dependability in the form of Koehring heavy duty construction.

Koehring-mixed concrete is **Dominant Strength** concrete, so established by official tests whereby Koehring mixed concrete has been proved to be as much as 31% stronger than concrete mixed by other mixers.

Due to the Koehring **re-mixing** action Koehring-mixed concrete is uniform in distribution of aggregate to the last shovelful of every batch.

Write for Koehring catalog No. B-5—a book that shows in detail Koehring heavy duty construction—shows you how to judge mixer value.

Koehring Capacities

in cu. ft. wet batch rating

Pavers 10, 14, 21 and 28 cubic feet mixed concrete, with or without loading derrick.

Construction Mixers, 7, 10, 14, 21, 28 cu. ft.

Hot Mixers for bituminous work, 9, 14 cu. ft. side charging type; 18 cu. ft. paver type.

Gasoline, Steam and Electric Power.

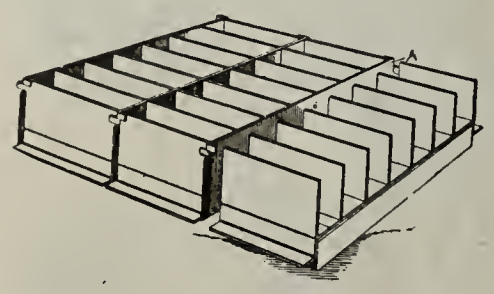
DANDIE LIGHT MIXER

Koehring Dandie Light Mixer—4 and 7 cu. ft. capacity, wet batch rating—a light mixer that brings dependability into the light mixer field—at a price that makes it the remarkable value of the industry. The reasonable investment mixer for miscellaneous work on big contracts, for footings, culverts, silos, etc., or for all general work within capacities. No. 104-S, gasoline, No. 107-S, steam and gasoline—may be equipped with standard or batch hopper, low charging platform, or power charging skip, automatic water-measuring tank or light duty hoist. Write for catalog B-45.

KOEHRING MACHINE CO., Milwaukee, Wis.

Sales and Service Offices and Warehouses in all parts of U. S.

MOULDS FOR POURED CONCRETE BRICK AND BLOCKS



Our brick molds are adapted for making both common and faced brick. Pallets are not used as the bricks are discharged from the molds, directly into the pile.

Our DOLLAR block mold is the only mold made, for poured block, that can be filled twice every day.

Write for circulars

MERRILL MOORE
Box 33, Creston, Iowa

REICHERT Adjustable Steel Molds

Improved locking device, saves time. Tight, accurate fit at joints produce smooth finish.

They help you land contracts
You can bid lower, at no loss of profit. Reichert Forms are standardized—units interchangeable. Ask for catalog.

Reichert Metal Concrete Forms Company
1188 Weil Street Milwaukee, Wis.

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16″ blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16″ back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

Make More Money out of Concrete Work!

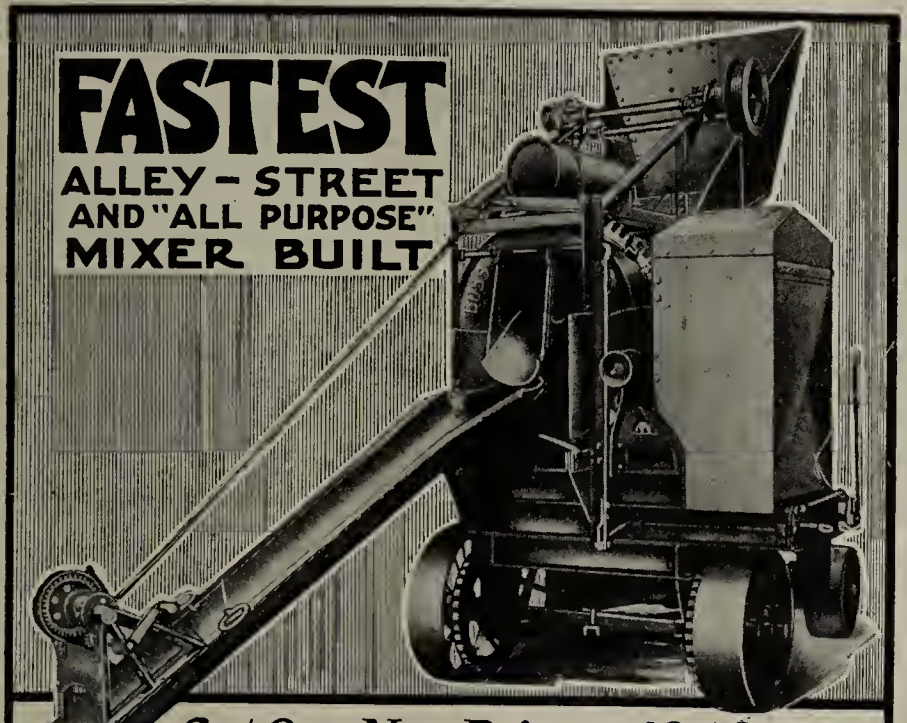
Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

FASTEST
ALLEY – STREET AND "ALL PURPOSE" MIXER BUILT



Get Our New Prices and Catalogs On Building and Paving Mixers (ALL SIZES) and Hoists

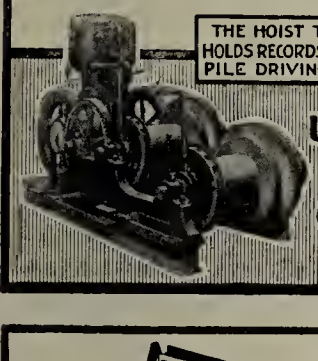
Write or Wire

The American Cement Machine Co. Inc.

Branch Offices In All Principal Cities

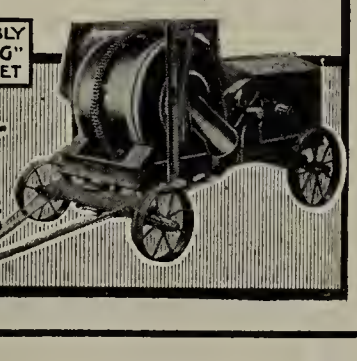
Keokuk Iowa
THE 300,000 H.P. ELECTRIC CITY

Prompt Deliveries From Stocks in Principal Cities



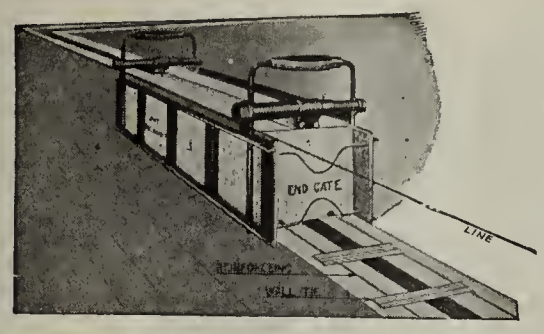
THE HOIST THAT HOLDS RECORDS FOR PILE DRIVING

MOST REASONABLY PRICED "ONE BAG" MIXER ON MARKET



Used By Over 6,000 CONTRACTORS

For 50% Build the Hollow Wall Way For 50%



Another most perfect Monolithic Hollow Wall Bungalow built with our molds at [illegible] Beach, Cal.

Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

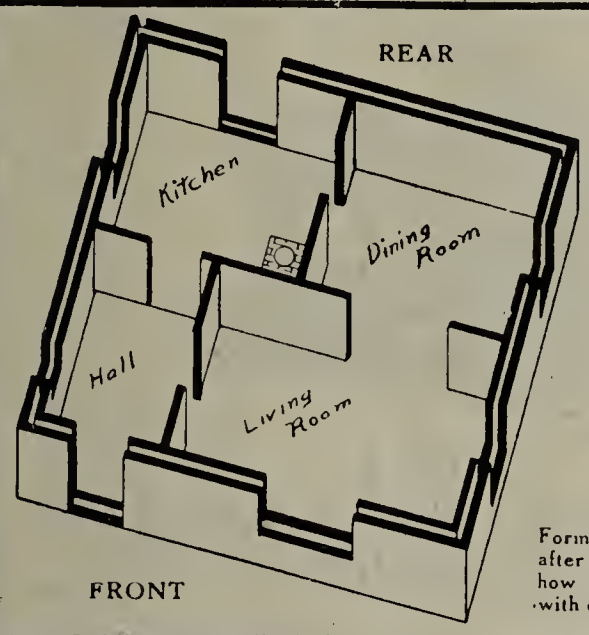
Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.



Forms removed from house after first pouring, showing how partitions are poured with outer walls.

The New Concrete Double Wall Form

These forms—in units 4 ft. high—are used for poured double or single walls. Conform to any plan. Easily assembled—quickly moved. They cut labor and lumber costs. All walls reinforced and tied together. M-M buildings are waterproof, fireproof and perfectly insulated. Complete description of the system will appear in the April issue of CONCRETE.

MIESS—McKAY BUILDING SYSTEM, Inc.
SALAMANCA, N. Y.

SAVE CEMENT

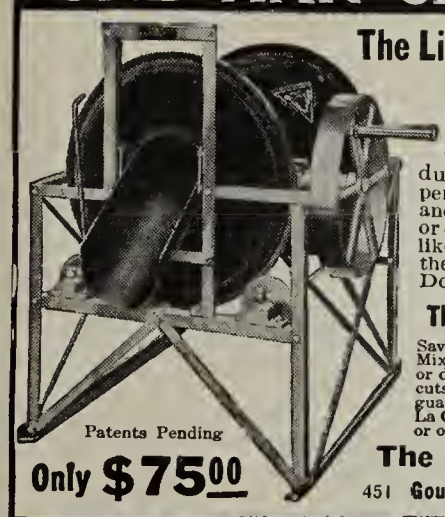
Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

Write us for particulars.

Handy Sack Baler Co.
620 S. 2d St.,
Cedar Rapids, Iowa

ONE MAN CAN RUN IT



Patents Pending

Only $75.00

The Little Whirlwind Concrete Mixer
THE MASTER MIXER
From Factory to You—Save 40%

Only *real practical* small mixer producing same *perfect* work as most expensive big machine. Complete with hand and power drive. A *winner* for the contractor or cement worker. *All steel and iron.* Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forms, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delays.

The Little Whirlwind Mixer Co.
451 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

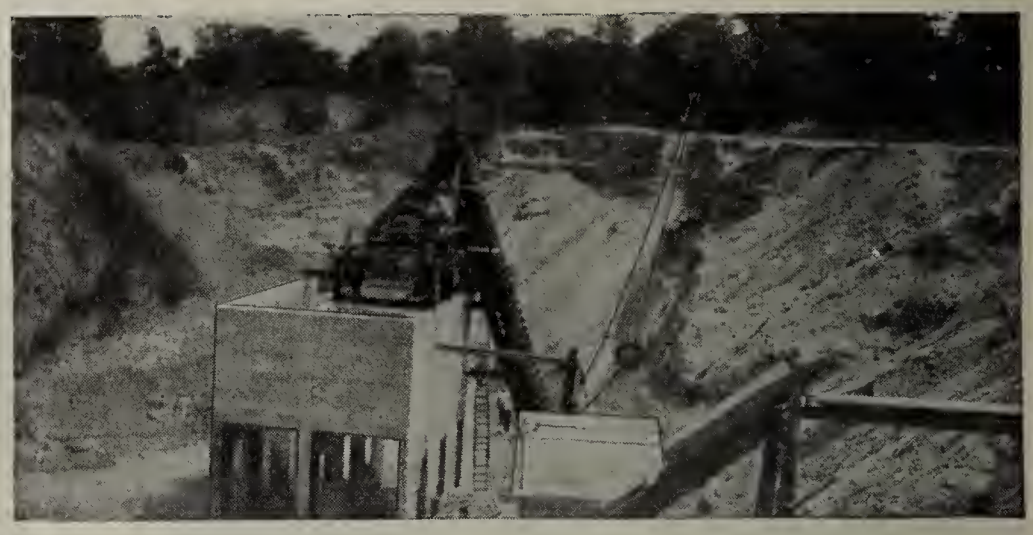


Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

Sauerman Bros., 1139 Monadnock Bldg., Chicago

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

POWER DRAG SCRAPER

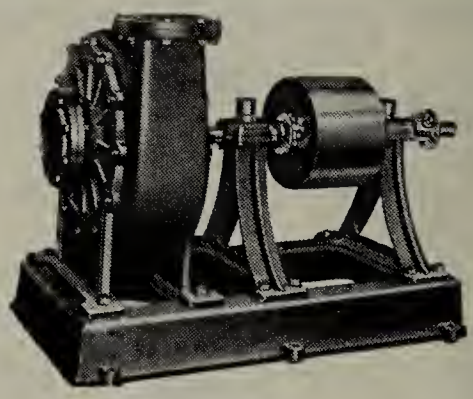
The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN

907 Lumber Exchange Bldg. Chicago



THE LIGHTNING SAND, GRAVEL AND DREDGING PUMP

Never Loafs!

The sand company or contractor who has used the Lightning Sand Pump longest, appreciates it most.

It has demonstrated its value and sure satisfaction in thousands of cases throughout the country.

It never loafs on the job, and its life is one long, unbroken streak of production.

Simple in design and construction—drum removable and adjustable to any position; drum sides quickly removable; Ball thrust bearings; front and rear. Shell and runner made of semi steel.

Write today for full information.

Kansas City Hay Press & Tractor Co.
Kansas City, Mo.

Cement and Engineering News

Vol. 34 Chicago, JUNE, 1922 No. 6

Modern Business Methods Urged for Concrete Products Manufacturers

E. W. Dienhart, Portland Cement Association, Minneapolis, Minn. at the recent annual convention of the Minnesota Concrete Products Association made an address, entitled "Modern Business Methods."

He wanted every manufacturer to locate himself on the business map, to observe the direction in which he is heading and to determine if he is in business to make a simple living or a living plus a reasonable profit. He outlined the need of standardization in specifications, in manufacturing processes, in cost keeping and accounting, in salesmanship and the elimination of waste due to improper use of materials, time or energy, either human or mechanical. Mr. Dienhart said:

"Modern business requires that every customer should be a satisfied buyer and therefore an advertisement. A reputation must be built up for square dealing and for quarity of products. The manufacturer must realize that his banker must have facts presented to him in connection with loans. Membership in chambers of commerce, trade associations, business clubs and other organizations will enable the manufacturer to keep alive to the growing needs of his community and how he could assist in satisfying those needs.

"To be successful worthy products must be made at a cost as low as consistent with quality. Prices must be low enough to sell and yet contain a profit which will permit the manufacturer to keep in business and to enlarge his manufacturing facilities as demand increases. A consistent and continuous selling policy must be maintained and advertising in the local papers must be a part of the sales policy.

"Low manufacturing costs depend to some extent on the plant location, the use of adequate capital, good equipment and a trained operating force. Errors in operation or personnel must be corrected as often as found.

"Modern business takes into account plant operating cost, interest on the invested capital, maintenance and upkeep of plant, rent, insurance, advertising and last but not least, depreciation of plant."

H. F. Barker, industrial engineer, Minneapolis, led the discussion of Mr. Dienhart's address and spoke briefly but instructively on the need of cost keeping, bookkeeping and accounting. He stated that cost keeping recorded the elements of cost of manufacturing, that bookkeeping recorded the business transactions involving the use of money and the accounting analyzed costs and financial records and enabled the manufacturer to ascertain his status at regular intervals. He indicated the necessity of proper accounting and bookkeeping to enable a manufacturer to make a clear statement to the U. S. Internal Revenue Department. Mr. Barker spoke as one very familiar with his subject and the need therefor.

Salesmanship Applied to Concrete Products

Leslie H. Allen, assistant manager, Cement Products Bureau, Portland Cement Association, spoke in a very interesting way of salesmanship and indicated the need of a manufacturer's knowing his products and his market. He showed the difference between an order taker and a salesman who goes out after orders—and gets them. The knowledge of the service to be rendered by the manufacturer's products and the co-operative service the manufacturer should give to his customers was indicated clearly.

Mr. Allen laid emphasis on the fact that if the present products makers desired to extend their market they would have to be real salesmen having a full knowledge of the properties, and qualities of their goods. Making and selling products are two different functions of the business and selling can not be neglected if success is to be achieved.

Will Make Artificial Stone

Manufacture of artificial Bedford stone will be entered into extensively by the Iron Mountain Cement Products Co., according to announcement by Thomas U. Stafford, proprietor. Small quantities have been turned out from time to time heretofore, and have met with such great success that Mr. Stafford believes manufacture on a large scale is warranted.

"This stone is just as handsome and durable as the genuine Bedford stone," he declares, "and it has the advantage of greater strength. We recently made a 16-foot span to go across the front windows of the new Payant block. Real Berford stone would not have supported its own weight in a piece of these proportions.

"We propose to manufacture the stone in regular architectural shapes, both for trim and for solid construction. By making it here in Iron Mountain, we will be able to sell it at a substantial saving over the genuine in freight charges alone."

The Anchor air-space concrete blocks turned out by the concern are meeting with a growing demand, according to Mr. Stafford. Inasmuch as the two sections of the block are jointed by steel tie-rods instead of a concrete web, they are claimed to be absolutely moisture-proof, and the dead air-space gives them a remarkably high degree of heat insulation.

Do the American People Like to Be Buncoed?

By F. A. Camp

P. T. Barnum, the great showman, used to say that the American people liked to be humbugged in the amusements he offered. Likewise it would appear that they like to be buncoed in respect to their patent system.

The final outcome of the case of Flat Slab Patents Co. vs. Northwestern Glass Co. in the Court of Appeals of the 8th C.C.A. sustaining the finding of the jury and ruling of District Court in favor of the building owner, brings to an end the country wide campaign of collecting royalty on a flat arch patent, by pretending that the arch was the equivalent of a continuous plate, upon no more scientific foundation than the inharmonious decrees of different benches of the 8th C.A.A. holding that the continuous plate was an unpatentable aggregation, in view of the suspension devise of Matrai 1896, (Cement Ar mé) 211 Fed. Rep. 466 and that the genius of one Turner had succeeded in infringing the mechanical equivalent of the unpatentable, embodied in the true and valid patent on a flat arch, applied for in 1901, five years later than the reference which rendered its mechanical equivalent unpatentable.

The incomprehensible relationship of a flat arch (with the steel in the bottom throughout) and the continuous plate with the steel in the top over the supports was established by accepting a "Joint Committee" Doctors' farcical testimony that the mode of operation would be the same before the concrete cracked, in both cases—hence the court concluded that putting the steel in the top of a floor is the plain mechanical equivalent of putting it in the bottom reversing the patent office and decreeing legal facts contrary to mechanical facts.

Thus the public was buncoed of three quarters of a million on the strength of one ignorant judicial decree—and such is a common and almost customary occurrence in the operation of the U. S. Patent system.

An engineer member of the Committee on Patent Reform asserts that in the analysis of sever decisions, one by the Supreme Court, three by Courts of Appeal and three by District Courts he found that of twenty-three holdings of mechanical law twenty-two were in error and every error constituted a reversal of opinion of trained engineer examiners of the Patent office.

Truly the performance of our judicial system in endeavoring to upset all known mechanical laws would present the greatest comedy of the age were it not for the enormous expense to the public and pitiable waste involved. Would not indeed an ordinary nickel in the slot machine settle such questions in law, in a less expensive and more expeditious manner?

From the standpoint of accuracy and precision it would have this marked advantage over the unscientific court, in that, by the theory of probability it could not go wrong more than half the time!

Then it would eliminate the petty fogging Patent Attorney who now successfully argues to a Court of Appeals that a mechanical law can not be true if it requires mathematics to demonstrate it.

It is believed by the author that this will be interesting to building owners who have been threatened with law suits and are readers of technical papers.

Cost of Producing Cement

Blaine S. Smith, General Sales manager, Universal Portland Cement Co., Chicago, submitted the following letter to the State of Illinois, Department of Public Works and Buildings, Division of Highways, Springfield, Ill., which may be of interest to our readers, viz:

"In response to your advertisement for bids to be received March 24, we submit herewith proposal on Universal Cement for use in the construction of state highways.

"The delivered prices specified, after deduction of cash discount and freight charges from our mill to destination, net us not over $1.50 per barrel.

"This price is 48½ per cent higher than our average mill price during the pre-war year, 1913. The latest report of the U. S. Department of Labor shows the January price of "all commodities" as 48 pe rcent higher than 1913.

"The principal elements in our manufacturing costs are coal, limestone, freight rates and labor.

"Our cost of coal at mines in February 1922 was 203 per cent greater than in 1913.

"Our cost of limestone at quarries in February was 60 per cent higher than in 1913.

Our wage scale in February was 54 per cent greater than in 1913.

"About 1¾ tons of raw material and coal are required to produce one ton of cement.

"Freight rate on coal in February was 107 per cent greater than in 1913.

"Freight rate on limestone in February was 52 per cent greater than in 1913.

"Please compare these increases cited above with the increase in price of Universal cement of 48½ per cent and the increase in price of all commodities of 48 per cent.

"In view of the foregoing we trust that you will accept our bid. We stand ready to furnish you with cement in the quantities and at the times you want it, subject to the conditions of our bid, and if given the opportunity, will give you the best of service in our power."

Concrete Blocks and Tile

I am a regular recipient of your valuable magazine and have received much good from reading the contents thereof, being more or less a beginner in this work.

I assume you welcome a line or so from people and as a member of Akron Cement Products Association, newly formed during past year, I want to inform you that the movement is gaining strength and we hope to add other cement products manufacturers in this county to our list. We had a very interesting meeting on May 16th and will have another meeting next week. Effective May 1st, all concrete block manufacturers were obliged under the Code to have blocks tested to Code standard which all goes for the improvement and forward movement of concrete work.

Our little Association, while small in number as yet, will undertake to entertain the Akron Builders exchange next month and while our plans are not yet completed, we hope to introduce a new innovation which will please members of Association and at the same time gain a little more prestige as an integral part of The Builders Exchange of Akron, Ohio.

(Signed) A. G. Freudeman, Secy.,
Detloff Cement Products Co., Akron, O.

The Effect of Alkali Upon Concrete*

By S. H. McCROY*

Decomposition caused and explanations of it offered. No method known of preventing such deterioration, but impermeability retards it. Recommendations as to aggregate, proportioning and placing of concrete.

The attention of engineers has been drawn recently to a number of cases in which concrete structures have partially or totally failed, due to the action of alkali upon the concrete. The extent and severity of this action has caused considerable concern among engineers intrusted with the design or construction of concrete structures in regions where the soils and ground waters are alkaline. Such conditions generally are found in the arid and semi-arid regions of the United States. Recently, however, a number of failures of concrete drain tile exposed to the action of alkaline soils and ground waters have occurred in the southwestern part of Minnesota. The mean annual rainfall in this region varies from 25 to 30 inches per annum and yet strong concentrations of alkalies are found.

The alkalis present in the soils are the salts of various metals. The more common are sodium chloride (NaCl), sodium sulphat (Na_2SO_4), magnesium sulphate ($MgSO_4$) calcium sulphate ($CaSO_4$), calcium carbonate ($CaCO_3$), and calcium bicarbonate ($CaHCO_3$). Other salts are also frequently present. Typical analysis of alkalis from the surface of the ground in various locations are shown in Table No. 1, which is taken from Technological Paper No. 95, Bureau of Standards.

Table No. 1—Typical analyses of alkalis from various localities.

	Composition of soluble solids in per cent.				
Location—	No.	K.	Ca.	Mg.	Cl.	So_4
Garland, Wyo.	30.8	0.5	0.6	0.1	Trace	68.0
Fort Shaw, Mont.	26.2	.2	2.3	1.1	1.1	69.1
Sunnyside, Wash.	23.9	.2	.6	.6	10.0	64.7
Yuma, Ariz.	24.7	.5	7.1	....	52.6	15.1
Roswell, N. Mex.	10.8	2.3	16.8	4.9	22.0	43.2
Montrose, Colo.	9.4	....	2.1	26.7	Trace	61.8
Grand Junction, Colo.	28.1	....	.7	6.6	17.1	47.5
Huntington, Utah	27.6	.6	2.4	2.5	.1	66.8

In Table No. 2 are presented a number of analyses of drain and soil water from various locations:

In both tables the SO_4 content is high for all localities except Yuma and Roswell. The alkali at Roswell, though low in SO_4, nevertheless causes serious injury to concrete that is exposed to it. It will be noted in these tables that usually some one of the constituents will predominate in a given section. Along the seacoast the predominating salt is usually sodium chloride (NaCl) or common salt, while in the Great Plains regions the sulphate type predominates.

Table No. 2—Analyses of drain and soil water from various localities

	Per cent soluble solids in	Percentage reacting values.							
Location—	water.	No.	Ga.	Mg.	Cl.	SO_4	CO_3	NO_3	HCO_3
Garland, Wyo.	0.33	32.0	10.3	7.7	3.2	40.6	6.2	....	....
Fort Shaw, Mont.	.20	30.6	6.6	12.8	1.6	34.2	14.2	....	....
Sunnyside, Wash.	.40	24.7	14.0	11.3	6.1	38.1	5.8	....	....
Yuma, Ariz.	.11	23.5	16.3	10.2	15.4	12.9	21.7	....	....
Roswell, N. Mex.	.46	23.9	19.4	6.7	27.1	20.0	2.9	....	....
Montrose, Colo.	.50	9.2	15.8	25.0	.5	46.0	3.5	....	....
Grand Junction, Colo.	.85	25.9	10.1	14.0	17.7	28.7	1.9	1.7	....
Huntington, Utah	.30	18.3	20.1	11.6	1.8	40.8	7.4	....	....
Lyon County, Minn.	.28	3.5	22.2	24.3	.3	47.5	.2	....	1.9
Lyon County, Minn.[1]	3.06	25.9	8.6	15.5	T	49.5	.1	T	.4

[1]Soil water.

The action of the alkali.

When concrete is exposed to the action of solutions of these salts the lime of the cement combines with the salts to form other compounds. The chemical action is accompanied by a change in the physical condition of the concrete. The first indication of the action of the alkali that can be noted is the presence of minute crystals of various salts in the concrete. These can be detected if fresh fractures are examined. As the action progresses a chalky band forms in the concrete near the surface which is in contact with the soil. In drain tile this band usually forms at first about three-eighths of an inch beneath the outer surface. As the action progresses the band widens and assumes a white chalky appearance, much like lime mortar. As this chalky band widens, swelling and cracking of the concrete become apparent. In one case of a 24-inch concrete tile which had been placed in an 11-foot cut and exposed for about four years to the action of soil water containing 2.22 per cent of alkali, of which 49 per cent was SO_4, the dwelling and cracking were very noticeable.

Most cencrete structures are alternately dry and wet. The alternate drying and wetting has a tendency to impair the concrete. When salts are present this deterioration is intensified, due to their crystallizing in the concrete when it dries. In most localities there is added to this action the disrupting effect caused by alternate freezing and thawing of the moisture in the concrete. While the effect of each of these factors on the concrete may be relatively very small, they combine to make the concrete more porus and thus to admit more readily the salt-bearing solutions to intimate contact with the cementing material. Some experimentors have thought that the disintegration of concrete was caused by the formation of substances having a large molecular volume and that this occurs when the sulphate salts of magnesium and sodium are present. The chemical reactions which take place are not fully understood, but it seems that failure is due to chemical rather than physical action.

A number of samples of concrete that have been subjected to the action of strong solutions of sulphates have been examined, and in each case it is found that a considerable amount of the cement has been removed. Microscopic examinations indicate that the cementing material has been replaced by other compounds of little cementing value, such as gypsum and the carbonates of lime and magnesia.

No proof against Alkali Found.

Many investigators have tried to find a method of making concrete that would be proof against the action of salts, but so far none has been successful. It has been shown, however, that the more impermeable the concrete, the more strongly resistant it is to the action of the salts. The strength of concrete does not seem to have a definite relation to the action of salts upon it as frequently, in testing concrete tile, specimens are found in which is seriously disintegrated but which shows little loss of strength when tested. In general, it may be said that all available data indicate that in sulphate waters the extent and rapidity of failure depend upon the concentration of the salts in the soil and soil water to which the concrete is exposed. Concentrations may occur which will cause the disintegration of the most impermeable concrete that can be made by methods now employed. Various experiments and investigations indicate, however, that when exposed to

*From "Public Roads," the official organ of the Bureau of Public Roads.

†Chief of Drainage Investigations, Bureau of Public Roads.

solutions of equal strength the richest mix will prove most resistant. Concretes with high absorption are especially susceptible to attack.

To secure most impermeable concrete.

If it is known that concrete is to be exposed to the action of alkalis, great care should be used in grading the materials so as to secure the densest and most impermeable concrete possible. If a choice is possible, the sand and coarse aggregate should be of such a character that they will not be affected by the action of the salts. Limestones, dolomites and sandstones should be avoided. In placing the concrete great care should be exercised to secure the best possible workmanship. The concrete, after being placed in the forms, should be well spaded and tamped, and extra precautions should be taken to prevent the formation of a porous layer at the close of each day's work. The foundation should, if possible, be thoroughly drained either by open ditches or underdrains. If this cannot be done, it might be helpful to make the backfill next to the concrete of coarse gravel, so that when the water table drops, capillary action will not bring the moisture to the concrete through the soil. When it is necessary to use sand, gravel or other aggregates that are known to contain alkali salts in considerable amounts, they should be thoroughly washed before they are placed in the concrete, even if alkaline water has to be used.

Various preparations have been used in an attempt to make concrete impervious to moisture. Cement grout, tar coating, ferrous sulphate and various waterproofing paints have been tried, but so far none of these seems to have been successful. Any value they have is of a temporary character. The use of integral waterproofing compounds or hydrated lime might be of value in securing a more impermeable concrete.

Where high concentrations of salts are known to exist, the importance of careful grading and rich mixture, so as to secure the densest and most impermeable concrete possible, cannot be overestimated. Under such conditions cement, sand, aggregate and mixing water should be the best obtainable. The fabrication of the concrete should be done by experienced workmen, and when it is placed in the forms it should be done in such manner that the structure will be truly monolithic. The foundation should be provided with the best drainage obtainable. If these precautions are followed structures can be built which will be strongly resistant to the action of alkali. There is no assurance, however, that concrete of even the highest impermeability that can be obtained under present methods of manufacture will withstand the stronger concentrations of alkali of the sulphate type.

Suction Hose

By R. McPeake*

The use of suction hose in dredging is well illustrated on the cover of the new booklet, recently issued by the Diamond Rubber Co., Akron, Ohio, entitled "Where Service is the Hardest," and on the second page of the same booklet you will see a cross section of the hose with one end of the heavy round wire protruding. This kind of hose is used by contractors who undertake dredging operations, and also by sand and gravel companies who dredge their products from the bed of streams. On the end of the hose which is under the water there is often a heavy strainer, and part of the severity of the service lies in the bending to which the hose is subjected as well as the pressure on the outside weight of material handled abrasion on the inside of the hose, and wear and tear from without. The water, often with a large percentage of sand and gravel, is pumped up through the suction hose, and then conveyed to the shore through a pipe line, which often rests on pontoons as shown on page five of the booklet.

Between the sections of iron pipe and attached to them with clamps, are dredging sleeves. These dredging sleeves are made with no wire insertion, so as to give greater flexibility. This is necessary on account of the shifting of the pontoons with the motion of the water. On page four there is a cross section showing one end of a dredging sleeve and the special reinforcement at the end, consisting of two plies of stout fabric, one inserted in the end of the inner tube, and one on the outside of the hose.

It would be difficult to estimate the amount of suction hose in use, but it is enough to represent, in the aggregate, a very large volume of business. The observing eye will soon discover prospective customers in any territory.

In taking orders for suction hose, the question of couplings or connections should receive proper attention. Orders are frequently received here which are incomplete in their specifications, and thus delay is caused which is very annoying to everyone concerned. All orders for suction hose 2″ in diameter or larger should specify whether the ends are to be straight or enlarged.

The point to be remembered is this,—suction hose may be used either with couplings or with nipples. When couplings are used, the hose is made of the same internal diameter throughout, and the couplings are simply inserted in the end of the hose as usual. However, when iron nipples are used, the outside diameter of the nipple is larger than the inside diameter of the hose, and consequently it is necessary to enlarge the end of the hose so that the end of the nipple may be inserted, and fastened with clamps. A flange is used on the end of the nipple, and when two lengths of suction hose are to be joined, the flanges on the ends of the two nipples are bolted together and the connection between the two lengths of hose is then complete. It is always advisable to use nipples rather than couplings with suction hose which is four inches in diameter or larger.

Another point to be considered in taking orders for suction hose is the question as to whether it is to be used for clear water or for water carrying sand and gravel. For the handling of clear water, rough bore suction hose is just as efficient as smooth bore, and it costs less. But for water carrying sand and gravel, the smooth bore construction should always be used, on account of the fact that the rubber tube resists abrasion and protects the wire and fabric from wear and deterioration.

*Assistant to Director of Sales, Diamond Rubber Co.

Shope Brick

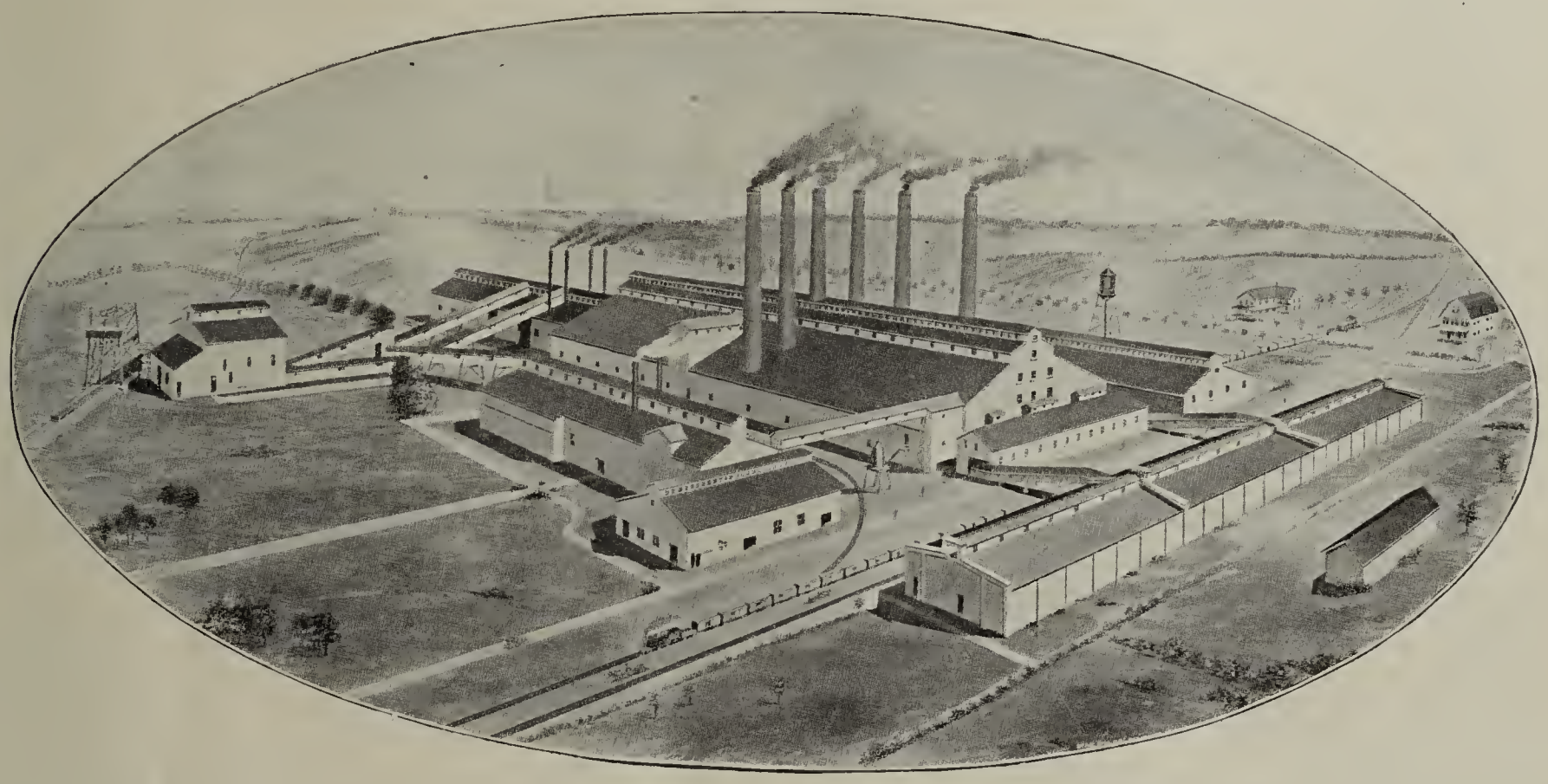
In Portland, Ore., D. F. Shope, patentee, Shope Brick Co., has developed the concrete brick business to a considerable extent, practically dividing fifty-fifty with the clay producing interests, the concrete brick going into large apartment houses, garages and, in the last year, into a large Montgomery-Ward building, which used a million and a half brick.

The Cement Mill of the Hawkeye-Portland Cement Co.

Some of the features of the 4,000-bbl. per da. plant of the Hawkeye Portland Cement Co., Des Moines, Ia., are indicated by the fact that coal is mined under the surroundings of the plant and hoisted directly into the coal crusher through a shaft in the mill building, and the use of a car unloader for receiving cars of stone and unloading them directly into the No. 18 McCully crusher.

General Arrangement

The arrangement of buildings may be understood by reference to Fig. 1. It will be seen that rock is received in cars at the crusher house, which is about



350 feet at right angles to the main axis of the plant. The layout of the crusher house is shown in Fig. 2. As the cars come in they are secured to the unloader and elevated to a point where they can be dumped into the hopper of a No. 18 McCully gyratory crusher, which reduces the stone to such sizes that it can be handled either by two No. 6 McCully crushers or a No. 6 Williams mill. Rock from the large crusher is elevated by a heavy type bucket elevator to a bin above the smaller crushers. These crushers are driven from a line shaft by belts and are operated by a 300-h. p. motor. A 36-in. belt conveyor takes the crushed rock into the raw end of the mill, where a storage is formed of steel tanks with 24-in. belt conveyor underneath. An extension storage has been formed which is reached by a belt conveyor which deposits the crushed stone in piles. The storage is drawn upon as needed by underground tunnels in which belt conveyors are installed. The raw grinding is done by grinding machinery consisting of three No. 85 F. L. Smidth Co. kominuters discharging into two No. 18 Smidth wet tube mills to complete the grinding. A comparatively small amount of clay is added in the form of shale taken from the coal mine. Eight 15-ft. x 40-ft. slurry tanks are provided. The slurry is handled by bucket elevators working in concrete housings and through horizontal screw conveyors. Three slurry tanks are of reinforced concrete. These have a section approximating three intersecting circles and carry three sets of agitating arms. Compressed air will also be used for agitation.

Six 8-ft. x 125-ft. kilns, belt-driven from individual motors, through reduction gears made by Foote Bros. Gear & Machinery Co., Chicago, are used. From the kilns the clinker is handled through three 6-ft. x 60-ft. rotary coolers which discharge the clinker into automatic scales, where the correct proportion of gypsum is added mechanically, and clinker and gypsum are together dumped into three bucket elevators, which carry the clinker into 15-ft. x 32-ft. steel tanks, from which it is drawn into pulverizing mills, belt-driven from individual motors. The finished cement is handled by a screw conveyor from the pulverizing mills back to the end of the finish grinding room, where it is discharged on a belt and carried about 200 feet to the top of the cement storage.

The cement storage building is of reinforced concrete 600 feet long. Screw conveyors in the packing room operate under the floor, the cement being drawn to them from the bins by scrapers operated by electric motors.

Coal Handling Equipment

The coal is received both from the mine direct through a shaft in the coal handling plant and by the cars. After it is broken to suitable size the belt conveyors carry the coal over a bridge and through the kiln room into the boiler room located on the opposite side of the kiln building. When the coal passes over these two belts it is automatically weighed on belt scales. Coal for the kiln is passed through Ruggles rotary driers and after grinding in the pulverizing mills, it is handled by screw conveyors to overhead

tanks and bunkers, from which it is drawn for use in the kiln.

Power Plant

The power plant consists of a row of seven 360-h. p. water tube boilers, all hand-fired and equipped with modern ash-handling conveying system, whereby the ashes are automatically carried from the boilers into an ash tank and from there by gravity into railroad cars.

The engine room equipment consists of one 1,000-k. w. and one 500-k. w. direct current generators driven by cross-compound Allis-Chalmers Corliss engines, one 600-k. w. DeLaval high pressure steam turbine-driven Westinghouse direct-current generator, and one 1,250-k. w. DeLaval low pressure steam turbine-driven by Westinghouse direct current generator. The low pressure steam turbine is driven by the exhaust steam from either two of the other three steam units.

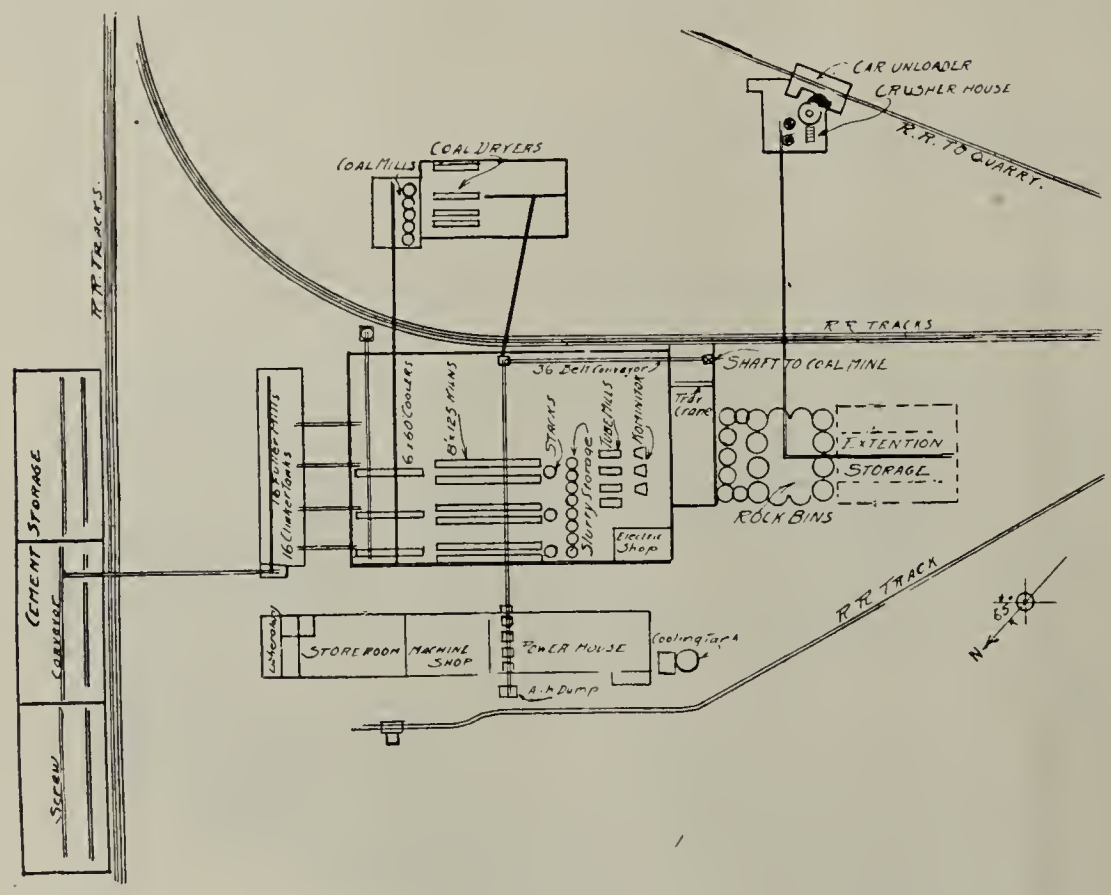


Fig. 1—Diagram Showing the Layout of the Hawkeye Cement Co.'s Mill, Des Moines, Ia.

A well equipped machine shop and an orderly kept storeroom for supplies and spare parts, as well as a neatly equipped laboratory complete the equipment for the manufacture of the cement.

Besides keeping the plant in good order and at high efficiency, the management is also taking good care of its men, as is evidenced when walking through the service building, equipped with 24 shower baths, 60 lavatories and 120 neatly arranged steel lockers, located in a steel and concrete building, which is kept extremely neat and clean.

The company is at the present time installing a waste heat system which will consist of three 800 h. p. waste heat boilers equipped with superheaters, economizers and turbine-driven fans. As soon as this is installed the company hopes to generate all its required power, and the old boiler room, with seven 360 h. p. boilers, will be used as auxiliary equipment only.

The Hawkeye Portland Cement Co. is the second oldest plant in Iowa. It has been in operation now for 12 years. The original design and construction were furnished by the Hunt Engineering Co., of Kansas City, Mo., and at that time it was operated as a semi-dry plant. Since then the plant has been redesigned by the F. L. Smidth Co., New York City, installing kominuters and tube mills, putting in a wet process, etc.

The spur gear speed reducing transmissions for operating the screw conveyors, belt conveyors, slurry maxing basins, slurry storage tank, kilns, driers, etc., were manufactured by Foote Bros. Gear & Machine Co., 228 N. Curtis St., Chicago, Ill.

Reducing Explosives Costs

A newly developed dynamite which, it is announced, will prove an important factor in reducing explosives costs in quarrying, road building, construction and other open work has just been perfected by the Du Pont Company.

The new "powder" is known as "Dumorite" and is

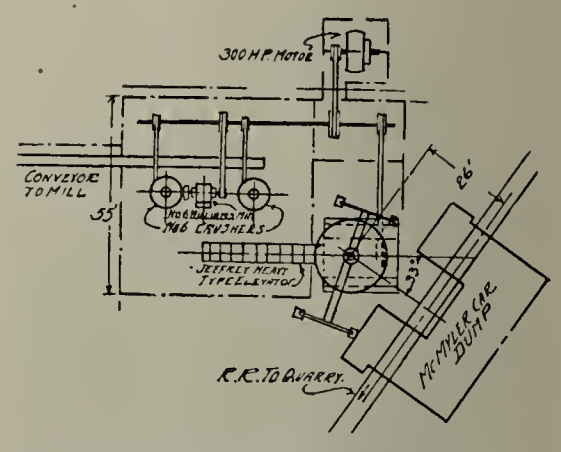


Fig. 2—Diagram Showing Arrangement of Car Dump and Crushers

made with a double base of modified nitroglycerin and gun cotton. It cannot freeze and does not produce headache.

In putting "Dumorite" on the market, the Du Pont Company announces that the explosive will effect savings of one-third on the dollar. It is as powerful, stick for stick, under ordinary conditions as regular 40 per cent dynamite, its economy consisting in the fact that each case contains approximately one-third more sticks.

"Dumorite" is a free-running explosive. It is stated to be quick and of great bulk strength. Before it was perfected, several hundred trial mixings were made up, all of which were carefully studied and analyzed by explosive experts. The final explosive was then subjected to every possible laboratory test. It was afterwards taken to the field, where it was tried out in actual work under varying conditions as to temperature, rock and kind of work. The results proved the new explosive to be especially adaptable for open work in quarries, construction and agricultural fields, for blasting hard rock and hard ores where the ventilation is good and for use in bituminous coal mines where a permissible is not required and where a large production of lump coal is desired.

Interpreting the Chemical Analysis of Portland Cement

Suggested System of Recasting Has Not Demonstrated Relationship of Such Results with Physical Behavior—By J. C. Witt, Structural Materials Research Laboratory (Co-operation Portland Cement Association and Lewis Institute), Chicago, Ill.

It is the purpose of this paper to discuss some of the tests that may be applied to a given sample of portland cement to determine its value as a material of construction. We are to consider the sample as representing a finished product, and the information that may be gained concerning it by applying tests, without presuming any detailed knowledge of the raw materials or the operation of the particular plant in which it was produced. That is, the statements made herein are applied to the testing of finished cement, and not to plant control nor research.

The limitation of chemical analytical methods have been in a measure taken for granted, and comparatively little discussion has found its way into the literature for some time past. The general opinion has been that the results of a complete chemical analysis add little to the information that may be obtained from a series of physical tests and often magnesia, sulphuric anhydride, loss on ignition, and insoluble matter are the only chemical determinations made. It is obvious that the composition of a cement is of the highest importance and is the determining factor of its quality. However, the nature of the material is such that comparatively little is revealed by the chemical analysis, though if the quality is not satisfactory, it will show up in one or more of the physical tests. Irregularities in composition that cannot be detected by chemical means may have a marked effect on the physical properties, and therefore physical tests have come into general use as the principal basis for deciding whether or not a cement is satisfactory for the use for which it is required.

Processes During Clinkering

The reason for this lack of relationship between the chemical analytical results and the true composition may be understood if we consider the changes that take place in the raw mixture as it passes through the kiln and is formed into cement clinker. The burning may be divided into three periods. These are not sharply divided, but gradually merge one into the other. During the first period, moisture and organic matter are expelled. During the second, the calcium carbonate is decomposed, the carbon dioxide being expelled, while the calcium oxide remains behind. During the third the calcium oxide unites with other substances present, the principal ones of which are silica and alumina, to form the mixture of chemical compounds which constitute cement clinker. The progress of the process during the first and second periods may be readily traced by chemical analysis. Successive samples taken from the upper to the lower end of the kiln show a progressive decrease in the percentage of moisture and carbon dioxide, and a corresponding increase in the percentage of calcium oxide and most of the other compounds present.[1]

After the beginning of the third period, practically no further appreciable change is revealed by chemical analysis. Volatile substances have been volatized and the chemical changes taking place do not involve any change in the proportion of the elements present. However, if successive samples are taken during this third period and subjected to physical tests, it will be found that they vary all the way from worthless material to cement of satisfactory quality. Assuming, therefore, that a properly proportioned and ground raw mixture enters the kiln, the quality of the resulting clinker is dependent on the last period of the burning process. The first two periods are simply preparatory for the third or most imortant period.

Recently R. J. Colony[2] has reopened the question of the value of chemical analysis in judging the quality of cement. He states that " . . . some additional mode of determining the quality of cement must be employed. The problem is to find a simple, usable, easily applied method that will supplement the standard tests. The solution of this problem involves a knowledge of the chemical composition of portland cements, also of their constitution (or componental composition), as the behavior of a cement, when gaged, is dependent on the physical and chemical characters of the compounds of which it is composed, the proportions existing between them, and the fineness of grinding. It is likewise essential to know the character, behavior and composition of the hydration of portland cement.

As the components of portland cement have a definite composition, the various oxides found by chemical analysis must be uniformly distributed and united with one another according to fixed laws of chemical combination. Hence it should be possible to recast an analysis in much the same manner as rock analyses, and to obtain the percentage composition of the cement in terms of the actual compounds, instead of the oxides of the elements forming the mass."

Components of Cement.

His method of calculation is based principally on the constitution of portland cement as determined by Rankin, Wright, and others at the Geophysical Laboratory. Work in this field has also been carried on at the Bureau of Standards and elsewhere. According to these investigators the principal components of portland cement are a series of calcium oxide and silica compounds, and calcium oxide and alumina compounds. Over 90 per cent consists of the three compounds, tricalcium silicate ($3CaO.SiO_2$), dicalcium silicate ($2CaO.SiO_2$), and tricalcium aluminate ($3CaO.Al_2O_3$). Colony proposes to calculate the amount of each of these three components from the chemical analysis. The carbon dioxide, sulphuric anhydride, ferric oxide and alumina are colculated to the corresponding calcium compounds. The remaining calcium oxide (which we shall designate as the net calcium oxide) is then applied to the total silica, and by means of simultaneous equations the amounts of tricalcium silicate and dicalcium silicate are calculated.

It is possible to determine the approximate proportion of the components of a cement by use of the petrographic microscope, and the chemical analysis of the material may be of some service in this connection. However, in this case, the real information comes from the petrographic examination, and the chemical analysis is only auxiliary, and may be dispensed with entirely.

In order to make clear the comments of the writer on this proposed system of calculating results (as he understands it), the various steps are indicated in the form of equations. For each compound to be considered, let P = the percentage, and W = its molecular

weight. Then, starting with the value determined by analysis in each case, we have
Carbon dioxide to calcium carbonate:

$$P_{CO_2} \cdot \frac{W_{CaCO_3}}{W_{CO_2}} = P_{CaCO_3} \quad (1)$$

In the same manner, $P_{CaSO_4.2H_2O}$, $P_{3CaO.F_2O_3}$, and $P_{3CaO.Al_2O_3}$ may be obtained.

The *net* calcium oxide, which we may designate as P'_{CaO}, may be calculated by the equation

$P_{CaO} + P_{CO_2} + P_{SO_3.2H_2O} + P_{Fe_2O_3} + P_{Al_2O_3} - (P_{CaCO_3} + P_{CaSO_4.2H_2O} + P_{3CaO.Fe_2O_3} + P_{CaO.Al_2O_3}) = P'_{CaO}$. (2) Now, having the net calcium oxide, P'_{CaO}, calculated as indicated, and the total silica, P_{SiO_2}, as determined by analysis, we may calculate the percentages of tri-calcium silicate and dicalcium silicate present in the cement by means of simultaneous equations, *assuming that these two compounds (and only these) are present.*

Let x = % tricalcium silicate = $P_{2CaO.SiO_2}$
y = % dicalcium silicate = $P_{3CaO.SiO_2}$
a = % net calcium oxide = P'_{CaO}
b = % silica = P_{SiO_2}

m = the ratio, $\frac{W_{CaO}}{W_{3CaO.SiO_2}}$

n = the ratio, $\frac{W_{CaO}}{W_{2CaO.SiO_2}}$

Then
$$x + y = a + b \quad (3)$$
$$mx + ny = a \quad (4)$$

Solving for x and y,

$$y = \frac{m(a+b) - a}{m - n} \quad (5)$$
$$x = a + b - y \quad (6)$$

Conditions in Ideal Cement

In discussing these equations and the analytical work on which they are based, let us assume two cases:

1.—An "ideal" portland cement made from chemically pure materials. The calcareous and siliceous materials are exactly proportioned, the burning has been continued at sufficiently high temperatures until the maximum amount of tricalcium silicate has been formed. After the clinker has been ground and cooled, the proper amount of chemically pure hydrated calcium sulphate ground to the same fineness has been added, and thoroughly mixed. The sample is then preserved in such a manner that it cannot absorb either water or carbon dioxide.

2.—A commercial portland cement of average quality, which passes all standard specifications.

In an ideal cement there should not be more than a trace of moisture of carbon dioxide present. There should be no difficulty in calculating the percentage of gypsum, tricalcium aluminate, and calcium ferrite—assuming that the formula given for the last is correct. Without going into the details of chemical analytical methods, it may be pointed out that every determination is subject to experimental errors[4] and results obtained by different laboratories do not always agree.[5] When the net calcium oxide is calculated by equation (2), the result is subject to the sum of practically all the analytical errors made in the complete analysis of the sample. It may happen that some of these errors compensate each other, but there is no way of knowing when this occurs and consequently it is not possible to make allowance for this in the calculation. While the error in the result of any one determination might be negligible, or even the algebraic sum of the errors for the complete analysis might be negligible (in some cases), it may be seen that there is always a possibility of a considerable error and the value for the net calcium oxide obtained by this roundabout method cannot be considered exact.

In calculating the percentage of tricalcium silicate and dicalcium silicate from the net calcium oxide and the total silica, use is made of what is termed "indirect analysis." In some cases, it is not possible to get complete information by making direct determinations, and in other cases the work is so difficult or so much time is required that direct determinations are not made. It is well understood, however, that such indirect analyses are only approximate[6] and that they should be used as sparingly as possible. The method is sometimes applied to the determination of sodium and potassium. If the weight of sodium chloride plus potassium chloride and the weight of the chlorine combined as chloride, or the weight of the chlorides and the sulphates are known, the sodium and potassium present may be calculated without determining them directly. The difficulty is that small experimental errors cause considerable differences in final results.

The errors that may arise in applying the principle of indirect analysis to calculate the percentage of tricalcium silicate and dicalcium silicate in a cement may be easily demonstrated. By placing first y and then x equal to zero in equations (5) and (6) and then, in each case, solving for b in terms of a, the values for silica which correspond to all tricalcium silicate, and to no tricalcium silicate, respectively, may be calculated. If we assume 45 per cent as the net calcium oxide value, the silica values are 16.2 per cent and 24.2 per cent respectively. Substituting these values in Equation (5) and (6), the first sample shows 61.1 per cent tricalcium silicate and no dicalcium silicate, while the second shows zero tricalcium silicate. That is, is round numbers, a difference of 8 per cent in silica corresponds to a difference of 61 per cent in calculated tricalcium silicate. In other words, in this one part of the system of calculation, an analytical error is multiplied by 7.5, or an error of 0.2 per cent in making the silica determination becomes an error of 1.5 per cent—which could hardly be considered negligible. In the same way, it can be shown that errors in the calculated value for net CaO have a corresponding—though smaller—effect on the final result.

Commercial Portland Cement

A recast analysis of a commercial cement is subject to all the errors just explained and to a number of others. These arise from the impurities in raw materials, differences in the manufacturing process at the various plants, contamination from the grinding machinery and fuel ash, and so on. It must be remembered also that the work on the constitution of cement was carried out with the ternary system, calcium oxide, silica, and alumina. While these constitute more than 90 per cent of an average cement nevertheless the minor constituents are by no means negligible and influence the reactions taking place in the kiln, by acting an a fluxes, for example. So many variables are involved that it it impossible to say just how the reactions known to take place with pure materials are modified under plant conditions.

Indirect analysis will not reveal whether a mixture consists of the two silicates alone, or the two silicates plus free calcium oxide. The fact that the analysis of a cement shows it to occupy a given position on the triangular $CaO—SiO_2—Al_2O_2$ diagram, does not necessarily indicate its composition in terms of tricalcium silicate, dicalcium silicate and tricalcum aluminate.

Without discussing the merits of petrographic methods, it is evident that the results obtained for tricalcium silicate and dicalcium silicate by the pro-

posed system of recasting chemical analyses are not dependable, because of the many sources of error that exist. Further, the practical value of such results even if accurate, is questionable, since the relation between the silicates and the physical properties of cement has not been fully established.

According to Rankin's paper[7] "Of these constituents, the compound tricalicic silicate is the one which hardens and develops the greatest strength within a reasonable time. This most important constituent, which is the one formed with the greatest difficulty, makes up only about 30 to 35 per cent of an average normal portland cement. It may be said, therefore, that the essential process for the manufacture of portland cement is the formation of this compound and that any improvement in this process yielding an increased percentage of tricalcic silicate will increase the cementing value of portland cement." However, Bates[8] is of the opinion that ". . . the composition of portland cement should be along lines which would not produce a great preponderance of either silicate. The ideal cement should possibly have an excess of the dicalcium silicate, which would give a not too dense hydrated material, gaining strength at later periods."

Equivalent Weight Ratios

Another recommendation made by Colony is that the ratio of the equivalent weight of the total calcium oxide to the equivalent weight of the total calcium alumina, and ferric oxide, respectively, is to be used as an indication of the quality of the cement. He is of the opinion that the minimum value for this ratio should be set at 2.4. It may be seen by consulting any book on cement manufacture that some such formula is always used for calculating the composition of the raw mixture. It is generally considered that, everything else being equal, the more calcium oxide present in a cement, the higher the strength (assuming proper burning), until the calcium oxide exceeds the equivalent of the other compounds present. In this case the excess of calcium oxide, will tend to make the cement unsound. Therefore, a maximum value for such a ratio is more important than a minimum, but neither should be specified until unmistakable evidence of the relationship has been obtained by comparing a large number of results of physical tests and chemical analyses, by a number of operators. Even then its usefulness is questionable, if physical tests of the cement have shown it to have a satisfactory strength and soundness. There are formulas for calculating the tensile strength of steel from the chemical analysis, and for calculating the calorific value of coal from its analysis. While these are of great value theiretically, we rely on the testing machine and calorimeter for making routine tests on these materials.

In the case of the analyses and physical tests of a number of samples of cement taken at random from the records of this Laboratory, there was no apparent relation of the tensile and compressive strength either to the calculated tricalcium silicate content, or to the calcium oxide ratio.

Summary

The information that may be obtained from the chemical analysis of a cement is limited. The percentage of the various components cannot be determined directly since they contain the same elements in common, and a system of indirect analysis is subject to so many errors that the results obtained are unreliable.

The system for recasting results of chemical analyses has not demonstrated any definite relationship between such results and the behavior of the cement when subjected to physical tests. The system does not give any indication of the degree of burning to which the clinker has been subjected, and it is of no value in showing the proportion of the components of the mix, since this is shown by the ordinary analysis.

The ratio of the calcium oxide to the other principal components may offer some indication of the strength of a cement, but is of little importance since the strength may be determined directly.

References in the article are as follows:

[1]Witt, Concrete (Mill Section), 16, 73 (1920).

[2]Transactions of the American Institute of Mining and Metallurgical Engineers; *Eng. News-Record*, 86, 637 (April 14, 1921).

[3]Cf. Rankin, J. Franklin Inst., 181, 747 (1916).

[4]Cf. Witt, Concrete (Mill Section) 16, 75 (1921).

[5]Cf. Meade, Portland Cement (Second Edition), 18; Grimm, "Tonind Zeit.," 33, 128 (1909).

[6]Olsen, Quantitative Chemical Analysis (Fifth Edition), 492.

[7]Rankin, loc. cit.

[8]Technologic Paper of the Bureau of Standards, No. 78, page 27.

Handbook on Reinforced Concrete Construction

The Corrugated Bar Company, Incorporated, has prepared a handbook on reinforced concrete construction that is in many respects absolutely unique—radically different from any other heretofore published on this subject. Its variation from customary handbook practice lies in the fact of its being prepared, not by theorists, but by practical engineers who have had many years of experience in the designing, detailing, and construction of reinforced concrete building.

It is a handbook in the true sense of the work—a reference or guide book for the designer and estimator —as essential to the reinforced concrete engineer as the structural steel handbook is to the engineer of steel structures. It aims to cover all the practical features included in their design and construction—piling for foundations, footings, retaining walls, columns, beams, floor and roof slabs, etc., etc.

The data is so arranged that the actual result is obtained directly from the tables. Thus, for example, architect, engineer or contractor with this handbook can quickly arrive at the quantities of material and reinforcement required for a given building for the purpose of estimating cost.

The book also contains much miscellaneous information as to the loads for which different kinds of buildings should be designed, and the loads allowable under various city ordinances.

It gives standard specifications for materials of construction.

It is in no sense an advertising book. It has been prepared because the company has been urged to do so by engineers who felt the need of something of this kind, prepared by some one who has had the experience this company has had with reinforced concrete construction.

"Useful Data" is priced at $2.50, which merely covers the actual mechanical cost of the printing and binding. The service of the company's engineering department in preparing the subject matter is gratis. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, 22 Quincy St., Chicago.

Successful Stucco Work

By E. W. HOLMES, Princeton, Ill.

Three hundred stucco houses and not one complaint, I believe it is one of the best talking points any stucco contractor can possbly have. To produce good work is the best advertising one can have, but to have people know about this good work it is necessary to adopt methods which will put the facts in their hands when they are considering building.

In this connection, we have used with considerable success a novel method of advertising by erecting a bungalow overcoated with our own granite stone stucco at the county fair gorunds. During the fair, we give away samples about three by four inches large to anyone that is interested in building, at the same time explaining that it is the same kind, which is used on the bungalow and which can be applied with equal success right on his own home.

The children also receive a nicely made little panel that they use in school for paper weights—the size is one and one-half by two and one-half inches. This is always saved and comes, no doubt, to the attention of the parents ever so often which naturally brings back to their minds the fact that we furnished it. When they are ready to build they will remember us. We have found we have received many contracts from these small samples.

Besides the bungalow we have hung up on the walls panels of 14x18 showing Pebble dash stucco in 135 different shades and colors that cannot fade. When this fact is called to the attention of the person who intends to build it shows him the possibilities of variety in stucco, without using artificial colors that might fade. We all want to have something different from somebody else, it is a fundamental thing in our nature. The thought that he can have something absolutely different is always well received, and in turn the possibility of the sale is almost always assured.

Aside from the county fair advertising, we send out direct mail letters together with samples of our stucco finishes. The letter explains the work and with each one we enclose a circular which states the advantage of stucco whether it be new or remodelling work. This personalized sales effort has indeed helped us to obtain many jobs, because a person who is going to build seldom receive such literature from a contractor, so when he does he will remember where it came from and in turn will favor you when he lets the contract.

We have often been asked how do you manage to get so many jobs. The answer is very simple. The same thing is true with a large manufacture of a universal product which has met with huge success.

The underlying cause for success is gained only through using the right materials and doing the work to the best of your ability. If you keep this in mind then you need not worry about the results, you are bound to win. There is nothing that will be better advertisement than a successful job to show other prospects, but to show other prospects it is necessary to advertise and advertise all the time.

The E. W. Holmes Co., Princeton, Ill., is one of the largest exclusive pebble dash stucco contractors in the country and they offer at a moderate price specifications to make and apply pebble dash stucco exactly as they have successfully applied it for 15 years. Made of Portland Cement and other materials cheaply obtained locally at a cost of 45 cents per sack. Compare this cost with other stuccos and you will find you will save the price of these specifications many times over on one small job. With their methods of mixing and applying this material no contractor can compete with you. Of the hundreds of jobs, the E. W. Holmes Co., have done they have never been called back to do any repair work. These specifications cover pebble dash work from start to finish and are so simply worded that any ordinary workman will be able to do the finest of pebble dash stucco.

Tearing Down a Brick Smoke Stack

Disposing of an old brick smoke stack by the usual method is a slow and costly procedure. Scaffolding has to be built and workmen begin at the top removing the bricks one by one with a mortar pick.

The stack stood on the plant of the Cadillac Motor Company, Detroit, Michigan. It was 125 feet high and built round on a hexagonal base. It was desired to remove the chimney quickly so that rebuilding on the site could be promptly gotten under way. It was decided to blast it down with dynamite as surrounding buildings had already been torn down and no damage was to be feared.

Ten holes were drilled in three faces of the hexagonal base. They were made about 18 inches deep and 3 feet apart. All holes were on the same side of the stack—the side toward which it was desired to have the stack fall in case it should fall at full length on the ground.

Two and a half pounds of dynamite were loaded in each hole and well tamped in with moist clay. Electric blasting caps were used so as to get an instantaneous shot. In all 25 pounds of 40% dynamite were used.

The shot was a success from every standpoint. The result was that the stack merely crumbled on its base, the blast having shot its support out from under it. No bricks were scattered beyond 20 feet from the base. Even if buildings had been very near, no damage would have resulted.

The fall broke up the chimney into sections small enough to be handled by one or two men, although comparatively few of the bricks were broken except immediately contiguous to the blasts.

It required less than two hours to tear down the stack and but a few additional hours to clear away the bricks and mortar so that building operations could be commenced on the site.

Wire Rope Users

Williamsport Wire Rope Co., with factory at Williamsport, Pa., and general sales offices in Peoples Gas building, Chicago, fires a broadside at every wire rope user in this country. This explains how it is possible to know that the purchaser gets the wire rope he buys, the rope containing a "telfax" patented tape marker in the center of the core, which indicates clearly the various grades of rope. This fact takes all chances of getting the wrong kind of rope, the various tapes indicating the kind of rope; for example, Williamsport plow steel being indicated by green lettering on a buff background.

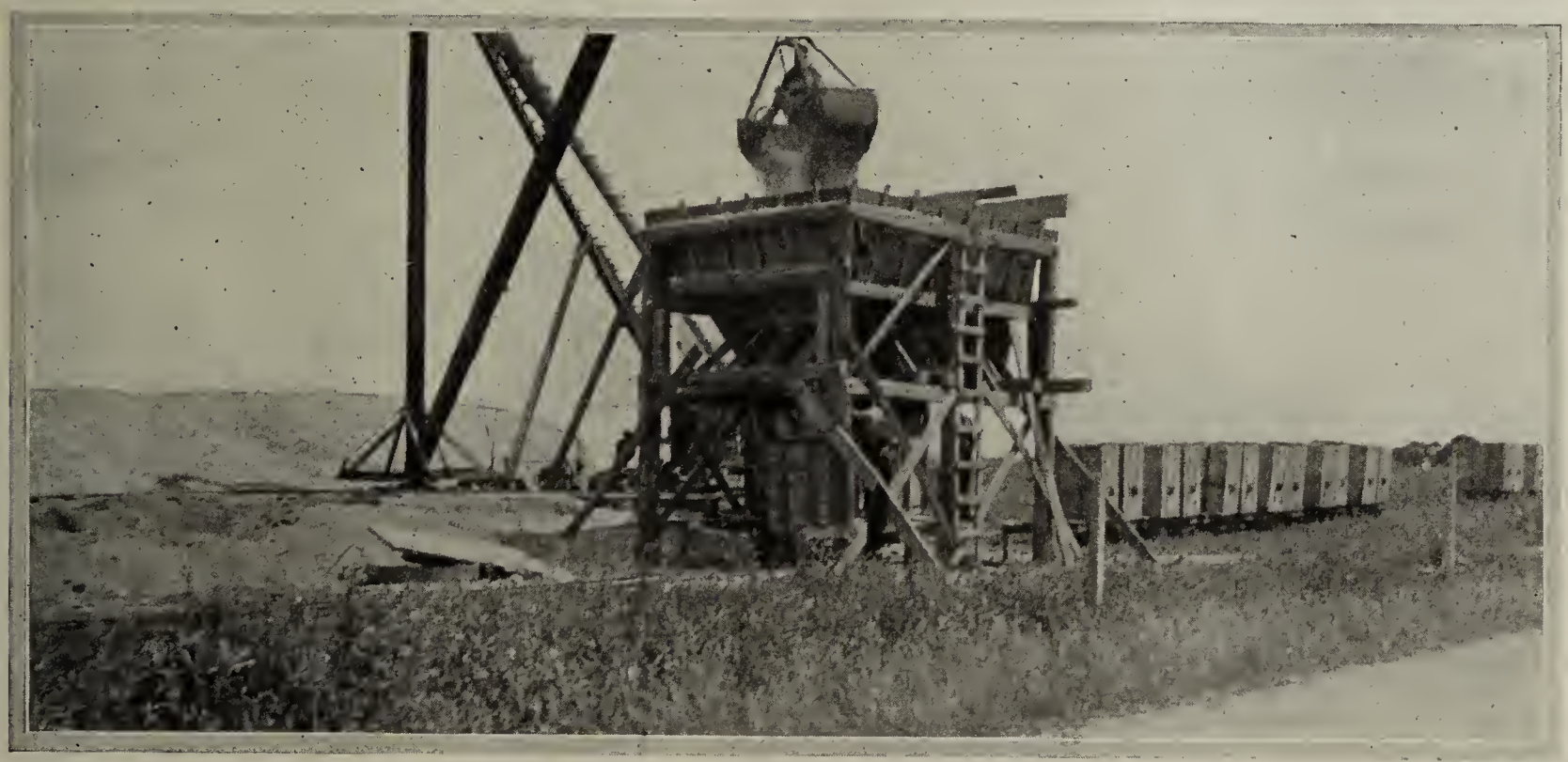
Concrete Road Construction in Indiana

The Cunningham Construction Company, Martinsville, Ohio, has a contract for building a little more than eight miles of concrete highway, known as Federal-aid Project, No. 4, a part of the old National Highway, near Coatesville, Ind.

At Greencastle, 13 miles away, is the plant of the Indiana Portland Cement Company. The contractors promptly arranged to haul the cement from this mill to their charging station in auto trucks. At Greencastle also are the Midwest Stone Company and the State Penal Farm, from both of which crushed stone is available. This stone is shipped to Coatesville, the nearest railroad station, and from there hauled three miles to the charging station. Arrangements were made to open a local sand pit, although some sand was shipped in that there might be no delay.

The road to be paved runs through a clay country, which was very wet as late as last May. The stone is received five miles from the charging station, with heavy grades intervening. There are 45,000 cubic yards of grading, including a heavy fill and a corresponding cut, three-fourths of a mile away. Ordinarily this haul would have been a dump wagon job but the ground was too wet for wagon hauling. The problem was solved very satisfactorily. An industrial railway would be necessary later in charging the mixer, and 50 V-shaped dump cars, in which it was planned to handle the stone, had been thoroughly overhauled and mounted on new Western running gear. Why not use this railway outfit for grading? The scheme was a great success, dirt being moved very rapidly and at a low cost by industrial railway, at a time when it could have been moved in no other way. When concrete work commenced, June 15, the grading had been more than half completed. An Osgood shovel, loading Western dump wagons, easily can keep ahead of the mixer.

After the industrial railway outfit had finished grading, it was set to hauling crushed stone, stock-piling it at what the contractors call the "charging station." The stone is received from Greencastle in hopper cars, which discharge by gravity into a pit; simultaneously the stone is loaded by belt conveyor directly into the small dump cars. Twenty-five loaded cars at a time are taken to the charging station five miles away, in a train hauled by a small steam locomotive. Two such trains are operated. On account of heavy grades it is necessary to "run" for some of the hills and to go up another in two sections. At the charging station the track climbs to the top of the stock-pile, where the cars are dumped. The train is taken up in two sections. A stifflegged crane lifts sand and stone as needed, into a small bin, from which batch-box trains are loaded by gravity. When concrete work began, there were 4,000 cubic yards of stone in the pile, pretty good guaranty that there will be no delays from



The Cunningham Material Bin near Coatesville, Ind., showing method of loading bin with Orton & Steinbrenner Clamshell Crane and loading batch boxes by gravity.

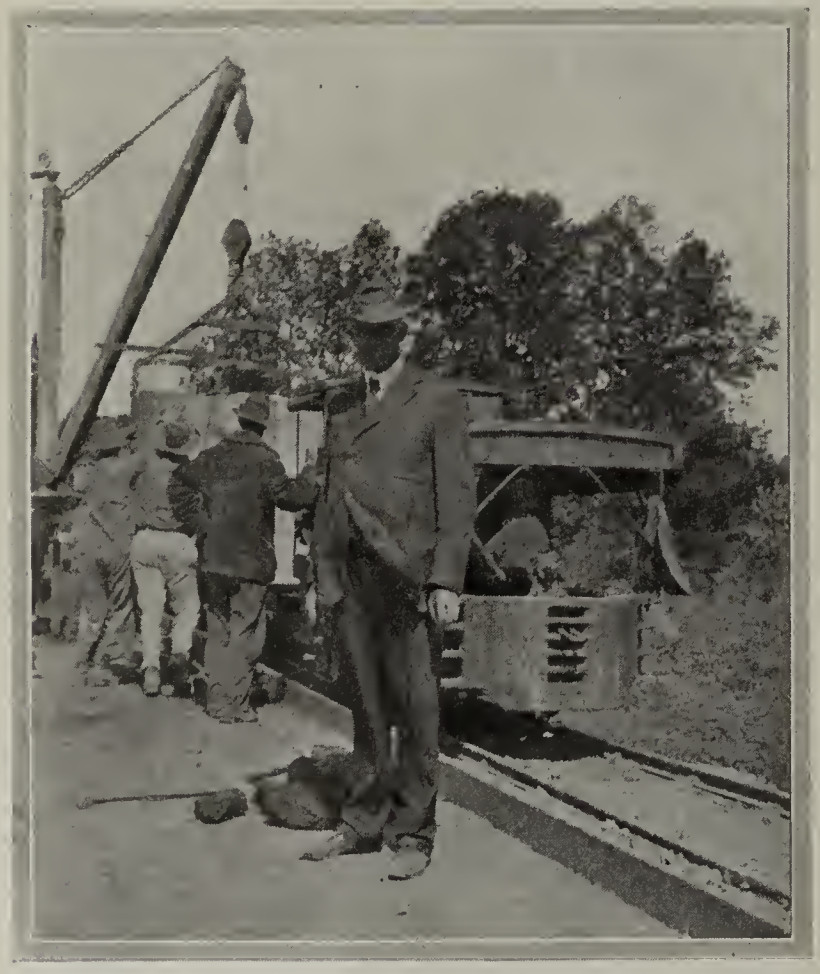
Unloading Machine at Coatesville. Stone is Dumped From Hopper Cars and Conveyed to V-Shaped Dump Cars

Unloading Crushed Stone at Stock Pile. Loaded Cars in Foreground are a part of the Divided Train Waiting to be Dumped.

Charging the Mixer—Home-Made Tip-Over Batch Boxes—Cunningham Contract. Casoline Locomotive and Train of Western Trucks on the Right.

that source. About the middle of June two daylight shifts were established on this work.

The concrete slab is being laid at the rate of 400 to 500 feet per day. The Indiana specifications, as prepared by H. K. Bishop, State Engineer, call for an 18-foot road of 1-1½-3 mixture, six inches thick at the edges and eight inches, at the center, with five-foot dirt shoulders. The direct-charging system is used by the Cunningham's to keep their Austin mixer busy, the charging station being about two miles from the point where the mixer started. The proportioned aggregates are carried in 100 batch-boxes on 50 Western Road Builders trucks. The loaded trains are pulled by three 3-ton American gasoline locomotives except on the heavy grades. The batch-boxes are made with three compartments to fit the mixture. Sand and stone are loaded from the bin, and cement added when the train passes the cement house.



Fred Cunningham, in Charge of Construction.

Grading Before Paving, Using Osgood Shovel and Western Dump Wagons.

The engineer was enthusiastic over the use of the industrial railway and batch-box system in handling materials. "When the material is scattered along the road," he said, "it is impossible to keep dirt out. In many cases the engineer is obliged to demand an extra screening."

In addition to the equipment described, the contractors have a finishing machine, two steam rollers, four miles of pipe line and two triple pumps, one held in reserve for use should the other break down. The

Showing Method of Adding Cement to the Batches.

tamping and finishing machine deserves special mention, being the first of the kind used in Indiana. It was manufactured by the Heltzel Steel Form and Iron Company of Warren, Ohio, from what are known as the Parrish patents. Alan Jay Parrish of Paris, Ill., the patentee, is himself a contractor.

Finishing Machine on Cunningham Road Work.

Lime Kiln Brick

It is an established fact that the conditions encountered in the burning of lime are such that the average high grade fire brick, as manufactured for general commercial purposes, will not give satisfactory service in lime kilns, and that a brick of special composition, manufacture and burn must be used if the best results are to be obtained.

The Crescent Refractories Co., Curwensville, Pa., have installed machinery which enables them to make from their clays a brick that will withstand the chemical action of the burning stone, as well as the mechanical action of the descending charge; "Crescent Quality" clays having sufficient refractories to withstand the intense heat necessary to burn the stone. The Crescent Company vary the proportions of Flint and Plastic Clay in the different brick to enable them to meet the conditions referred to above.

The best results can be expected from using "Crescent Quality" for the arches and heat zone, and for the remaining portions of the kiln.

The regular 9 inch and 13½ inch series brick are generally used in lining lime kilns. Some types of lime kilns require special shapes, but all can be had by writing the Crescent Refractories Co., who strongly recommend that "Crescent Quality" fire clay be used in the setting of fire brick linings in lime kilns.

Strength of Concrete at Increasing Intervals

By Ross C. Durst, Assistant Professor of Civil Engineering, Municipal University of Akron, Ohio

The tables below show the results of an experiment performed in the regular laboratory testing classes in the University of Akron, Ohio. Eight parties made tests which are averaged in the tables. The object was to determine the loss in strength caused by using concrete which had been allowed to stand for some time before using. The tests were performed with 1:3 mortars, using a variety of brands of cement.

Table I. Strength of Concrete Molded at Increasing Intervals After Mixing

(Lb. per Sq. In.)

Time After Mix	Av. Tens.	Av. Comp.	Per Cent of Normal Tension	Per Cent of Normal Comp.
Normal	383	2,396	100.00	100.00
1 hour	338	2,410	88.2	100.6
2 hours	336	2,367	87.9	98.7
3 hours	323	2,019	84.3	84.3
4 hours	299	2,228	78.0	92.9
5 hours	269	1,508	70.2	62.9
6 hours	235	1,392	61.4	58.1
7 hours	208	1,401	54.3	58.5
8 hours	168	1,108	43.9	46.2
9 hours	111	555	28.9	22.9

In the experiments in Table I the entire mass was thoroughly mixed, using normal consistency. At intervals of one hour, just sufficient material for molding a sample was cut off and molded, leaving balance of mass undisturbed. In the experiments of Table II the same procedure was followed except the entire mass was remixed at intervals of one hour. The experiment given in Table III was performed very carefully by two seniors using ½ hour intervals. They also ran a third test adding a small amount of water each time.

Table II. Strength of Concrete Remixed at Intervals of One Hour

(Lb. per Sq. In.)

Time After Mix	Av. Tens.	Av. Comp.	Per Cent of Normal Tension	Per Cent of Normal Comp.
Normal	348	2,014	100.00	100.00
1 hour	328	2,238	94.25	111.1
2 hours	335	2,253	96.26	111.8
3 hours	322	1,162	92.53	107.3
4 hours	291	1,945	83.6	96.6
5 hours	289	1,794	83.0	89.7
6 hours	205	1,324	58.9	65.7
7 hours	192	1,135	55.2	56.3
8 hours	179	1,013	51.4	50.3
9 hours	145	565	41.7	28.0

Test III. Strength of Concrete at Intervals of One-Half Hour

(Lb. per Sq. In.)

	Remixed		Unmixed		Tempered	
Time of Making	Tens.	Comp.	Tens.	Comp.	Tens.	Comp.
Normal	315	2,700	347	3,680	268	3,017
½ hour	341	2,767	335	3,217	287	2,822
1 hour	355	3,590	362	3,818	322	2,797
1½ hours	387	3,325	366	4,090	310	3,085
2 hours	432	3,577	370	4,037	222	3,230
2½ hours	420	3,427	360	3,900	320	3,212
3 hours	349	3,370	372	3,830	306	2,895
3½ hours	382	2,870	397	3,520	312	3,075
4 hours	316	2,840	367	3,837	334	3,577
4½ hours	324	3,012	347	3,085	287	3,287
5 hours	346	2,712	315	2,935	332	3,617
5½ hours	312	2,835	302	2,335	364	3,355
6 hours	203	1,948	243	2,257	325	3,740
6½ hours	233	2,075	277	2,255	341	3,610
7 hours	170	1,742	235	2,170	358	3,312
7½ hours	207	1,360	201	1,477	387	3,250
8 hours	121	800	156	1,510	320	3,585
8½ hours	228	1,540	214	1,902	326	4,207

Three briquettes made from Pile No. 1, and immediately immersed in water gave the following test:

Tension	Comp.	
153	1,425	Average tension of 168 lbs. and compression of 1,472 lbs.,
214	2,037	which shows that the immersion in water did not help to
137	955	increase the strength.

As shown by the last column of Table III there was a slight but continuous increase in strength showing a greater strength at the end of 8½ hours than at the beginning. No sweeping conclusions can be drawn from these results. They seem to indicate that very little strength is ever lost up to the third or fourth hour while in practically every case there is an increase in strength at the end of the first hour.

Hardening Concrete Floors

Sometimes Defects in Workmanship Make Use of Remedies Advisable. By Edward D. Boyer, New York City, Member of Committee on Surface Treatment, American Concrete Institute

Concrete floors can be laid so that they will be hard, durable and dustless. This fact has been established by the countless floors so laid. Every builder and contractor realizes this because most of his floors fall in the class of perfectly satisfactory jobs.

Yet, as in all things human, there exists the chance that for some reason or other the very best results are not obtained. Usually the trouble is due to some fault in workmanship—and every contractor knows how hard it is to give every detail of perhaps several jobs his personal and undivided attention. So the workmen do not give the materials a good thorough mixing, or use too much water, or do too much troweling of the surface. Perhaps they dust on dry cement to dry the surface so it can be finished sooner. At any rate the job is not just what it should be. What is to be done?

A number of simple but very successful treatments have been developed to harden floors and prevent them from dusting. These treatments might be termed "home-made remedies" for they can be made up and applied by the contractor's own men. There are on the market also numerous very excellent floor treatments for the contractor who prefers for convenience to buy his hardener ready prepared.

Types of Floor Treatment

Floor treatments fall into three general classes:

1. Materials which penetrate the concrete and form insoluble compounds by a chemical reaction with the cement. In this class are sodium silicate, magnesium fluosilicate, aluminum sulphate, zinc sulphate, etc. These treatments fill the pores of the concrete and harden the surface.
2. Oils and Waxes used to fill the pores of the concrete and to prevent dusting by binding any loose or friable particles.
3. Floor paints and coatings used to provide a protective film for both appearance and wear.

The "home-made remedy" much used because of its ease of application and low cost is sodium silicate, or "waterglass." This is the same liquid used by the housewives to preserve eggs. It may be purchased in every locality at a price of 40 cents or less per gallon.

Tests by Bureau of Standards

A series of service tests of all classes of floor hardeners has been conducted by the U. S. Bureau of Standards since early in 1918. Slabs in one of their buildings were treated, a different material being applied to each slab. As the slabs were selected so as to have equal wear, the effect of each treatment could be compared. Among their conclusions they state:

"Two home treatments have proven very successful and are quite inexpensive to apply. The following instructions are given for the use of the home treatments:

Sodium Silicate Treatment

"Commercial sodium silicate usually varies in strength from 30 to 40 per cent solution. It is quite viscous and has to be thinned with water before it will penetrate the floor. In ordinary cases it will be found satisfactory to dilute each gallon of the silicate with four gallons of water. The resulting five gallons may be expected to cover 1,000 sq. ft. of floor surface, one coat. However, the porosity of floors varies greatly and the above statement is given as an approximate value for estimating purposes.

"The floor surface should be prepared for the treatment by cleaning free from grease, spots, plaster, etc., and then thoroughly scrubbed with clear water. To get the best penetration the floor should be thoroughly dry, especially before the first application, and if practical it is well to let it dry for several days after the first scrubbing. The solution should be made up immediately before using. It may be applied with a mop or hair broom and should be continuously brushed over the surface for several minutes to obtain an even penetration. An interval of 24 hours should be allowed for the treatment to harden, after which the surface is scrubbed with clear water and allowed to dry for the second application. Three applications made in this manner will usually suffice, but if the floor does not appear to be saturated by the third application, a fourth should be applied.

"This treatment when properly applied gives a very hard surface that is bright and uniform in appearance. The commercial sodium silicate can be obtained from wholesale druggists usually at a cost of 40c, or less per gallon.

Aluminum Sulphate Treatment

"The solution of aluminum sulphate for this treatment should be made in a wooden barrel or stoneware vessel. The amount required may be estimated on the basis of one gallon of solution for each 100 square feet of area. For each gallon of water 2½ lbs. of powdered sulphate will be required. The water should be acidulated with commercial sulphuric acid by adding 2 c.c. (about ½ dram) of the acid for each gallon. The sulphate does not dissolve readily and has to be stirred occasionally for a period of a few days, until the solution is complete.

"The floor should be cleaned of grease spots, plaster, etc., then thoroughly scrubbed. When the surface is entirely dry, a portion of the sulphate solution may be diluted with twice its volume of water and applied with a mop or hair broom. After 24 hours dilute a portion of the original solution with an equal volume of water and apply in the same manner as the first. Allow another interval of 24 hours and make an application using two parts of the sulphate solution to one part of water. Each application should be continually brushed over the surface for several minutes to secure a uniform penetration. After the third application has dried, the surface should be scrubbed with hot water.

"This treatment will give good results at a cost about equal to that of the sodium silicate treatment."

Commercial Floor Hardeners

There are on the market some meritorious floor hardeners which can be used with good results where a floor is defective. Many contractors prefer to buy their floor hardeners in this way rather than prepare them.

The wise contractor, however, will endeavor by careful supervision to insure a good floor in the beginning rather than to depend on floor hardeners — either "home-made" or commercial—to correct the defects of faulty workmanship.

Use attractive signs at your plant and on your delivery trucks. If you are proud of your concrete products let the world know your name and address.

Make more and sell more *quality* concrete products.

Hydrated Lime in Concrete

Hydrated lime is used in concrete for two purposes. First, it acts as a lubricant in mixing, pouring, and placing. Secondly, it is the most effective waterproofing agent available.

The lubricating action is due to the fact that lime is very smooth and fat, and very finely divided (at least 95 per cent passing a 100-mesh sieve). The mixture of cement, hydrated lime and water forms a smooth film over each particle of the aggregate and thus smooths the way for the easy flow of the mass, in a manner similar to that evidenced by a film of oil used for lubricating a bearing, which prevents the direct grinding action of metals.

Waterproofing.

Concrete is impermeable, or watertight, when it does not permit the passage of water through its pores or voids. If the voids between the particles are sufficiently large and connected, water will seep through in greater or less amounts, depending upon the size of the voids. One way to eliminate this difficulty is to fill up the voids, or render them so minute as to prevent the water from seeping through. This reduction, or elimination of voids may be accomplished in two ways. One is to use a rich mixture, carefully proportioned and graded aggregates, careful supervision, and high-class workmanship.

As it is extremely difficult to obtain the necessary well-graded aggregates and careful workmanship, this method becomes too expensive for common use. Some other way to attain the same result without such expense must be sought. This leads to a search for some material that will reduce the voids, and not injure the strength of the concrete.

Qualities Required.

After many years of consideration, engineers are agreed that the substance to be added in the mix should possess the following properties:

1. It should in no way injure the concrete, either chemically or physically.
2. It should be preferably of a character chemically similar to that of cement.
3. It should enter the mixture in its most effective form and not rely for its waterproofing quality on chemical reactions, which have to take place after it is brought in contact with the ingredients of the concrete.
4. It should be permanent and not subject to decomposition or decay, and therefore should be mineral rather than organic.
5. It should be finely divided, bulky, and preferably of a colloidal nature, so as to lubricate the mass during handling and placing, and act as a void filler in the hardened concrete.
6. It should mix readily with water, and adhere to the other ingredients of the concrete.
7. It should be convenient to handle, and easy to proportion and incorporate in the mix.
8. It should be inexpensive, so as not to increase the cost of concrete materially.
9. It should be a staple material, produced in all parts of the country, rather than a specialty.
10. It should be obtainable wherever Portland cement is sold and used.

Summary.

From a consideration of these requirements, we see that hydrated lime qualifies under every head. In recommended amounts it does not injure the concrete in any way, but increases the workability to a marked degree. It is ready for use and does not deteriorate. It is a staple material which is easy to handle, proportion, and mix, and is not expensive.

The use of hydrated lime for waterproofing concrete and increasing its plasticity, is continually increasing, and many cities, even the more conservative, which do not allow a material to be used until its worth has been demonstrated by the test of time, now permit the use of small percentages of hydrated lime.

Some Points on the Design and Selection of Screening Machinery

The proper designing of screening machinery units and the correct selection of adaptable eqiuipments requires skillful handling involving decisions which are necessarily based on practical as well as theoretical facts.

Many factors widely variable such as the composition of the aggregate, the products desired and the capacities required, have direct bearing on the kind of machinery which will best deliver the desired results.

Engineers interested in separation machinery have given study to the various shapes of perforations for certain duty. Round, square, oblong, oval, elliptical and other perforations are placed regularly, staggered diagonally and in other arrangements to give special results. The method of mounting is variable, being flat, inclined, cylindrical, conical, and often the plates are stamped in step fashion to produce certain action sometimes desired in screening.

One of the most important features of screen design is the motion. Stationary and gravity screens are supplemented by power driven units which are classed as revolving, rocker, reciprocating, vibrating, shaking, oscillating and other actions not so commonly employed.

When recommendations are made for some screening proposition, the nature of the material, the size of the products required and the capacity desired, must be taken into careful consideration. Decisions relative to the selection of screens and screening machinery should be entrusted only with experts who have an actual knowledge of operating conditions.

Send Traylor Engineering & Mfg. Co., Allentown, Pa.; Austin Mfg. Co., 400 N. Michigan Ave., Chicago; or Link Belt Co., 910 S. Michigan Ave., Chicago; or Chalmers & Williams, Chicago Heights, Ill., a rough sketch showing your screening problem with an outline of your separation requirements. Their engineers will present recommendations involving correct principles for the economical handling of the project.

49th Year of Chain Making

The S. G. Taylor Chain Company are now in their forty-ninth successive years of chain manufacturing, having been organized in 1873.

Recently they have made several additions to their factory and also improvements in the manner of welding their Steam Shovel Chain to keep abreast with the demand for high-grade Steam Shovel Chain.

Their office is located at 640, Marquette Building, Chicago, and their factory, at Hammond, Indiana, where they produce their high-grade Taylor-Mesaba Chain which is a product made of a special grade of iron thoroughly rerolled and refined, free from steel or scrap. They also make a complete line of high-grade chain of all descriptions.

Building the New Pyramid Plant

Rapid progress is being made with the construction of the Pyramid Portland Cement company's plant at Valley Junction, near Des Moines, Iowa. Steel is on the ground for the buildings, which will be erected around the machinery when it is all installed. Two kilns, each 240 feet long, will be used. One has already been put in place, and the other is in process of erection. Officials of the company expect to begin production this year. Work was started on the plant early in 1920. It will be equipped for wet process cement making, and will cost approximately $2,000,000. The cut shows the storage and crusher departments, the laboratory building and a kiln. Capacity of the plant will be 3,000 barrels a day. Shale will be obtained from deposits on the 110-acre site on which the plant is located, and limestone from a quarry at

Gilmore City, Iowa. Location of the plant at Valley Junction rather than at the quarry was decided on, according to the company's officials, because transportation, fuel and labor conditions were more favorable at Valley Junction. The Rock Island and the Minneapolis & St. Louis roads run by the company's property. Officers of the company are: President and general manager, Edwin Struckman; vice president, F. H. MacKaman; secretary, W. A. Harper; treasurer, A. O. Hauge. It has $2,000,000 capital.

Review of Recommended Ordinance for Construction of Chimneys

The National Board of Fire Underwriters has just issued in pamphlet form a valuable code on "The Construction of Chimneys."

Section I, of the suggested code, deals with the various types of chimneys and materials. The type of construction for each class is specified, and typical sections are shown to bring out special features.

Type of Mortar Specified

According to this code, "All mortar used in chimney construction, except as specified for fire brick in paragraph 13, should be proportioned as follows: 2 bags of Portland cement, 200 lbs., and 1 bag of dry hydrated lime, 50 lbs., thoroughly mixed dry. To this mixture shall be added three times its volume of clean sharp sand, with sufficient water to produce proper consistency. When dry hydrated lime is not available, 1 cubic foot of completely slaked lime putty may be substituted for 50 lbs. of dry hydrate. In case of such substitution the mixing shall be very thorough. . . ."

Woodwork Around Chimneys

Section II of the code deals with woodwork around chimneys. In this section are set forth the recommended precautions for fire stops and best methods for framing around chimneys, flues, and fireplaces. This section is followed by a short list of practical suggestions for the repair of old chimneys.

A number of excellent plates showing approved methods of framing around fireplaces and chimneys are contained in this code, which aid materially in supplementing and emphasizing the text.

Losses from Fire

When we realize that the fire loss in the United States for the years of 1916, 1917, and 1918, was over $12,000,000 per year, we can appreciate the enormous waste now being permitted through poor construction. All losses were not reported, and it is estimated that the actual loss was at least one-third larger. Many lives also were sacrificed in the 23,000 fires which produced this property loss each year.

Since fires caused by improper chimney construction are classed as "strictly preventable," no further argument should be needed to urge the adoption of a suitable ordinance, such as the one proposed, by every municipality or state.

Builders would do well to secure a copy of the code, which may be obtained from the National Board of Fire Underwriters in New York City.

This code has been endorsed by several large organizations, such as the American Institute of Architects and the National Brick Manufacturers' Association.

Caterpillars for Railroad Type Shovels

The Bucyrus Company has recently announced that it is prepared to equip all sizes of railroad type shovels with caterpillar traction.

This announcement, because of the economies of operation thus made possible, should prove of particular interest to all present users of railroad-type shovels as well as to prospective purchasers.

This installation may be made on all sizes of railroad type shovels up to the heaviest now built.

The principal advantages of mounting a shovel of this type on caterpillars may be summarized as follows:

No time lost in moving up.
An ordinary move requires about 10 seconds only.
No rails to lay.
No jacks to release and set.
No stops during operation to reset jacks.
The shovel is always ready to dig.
The shovel does not have to face blasting.
May be moved back out of way quickly and easily.
Can be turned around quickly.
No track trouble when in water.
In emergencies, such as slides, can be moved back quickly out of danger.

A Good View of the Two Forward Caterpillars

Shovel can always dig at most effective distance from bank; short moves easy and quick to make.
No delay on account of boulders rolling in close to shovel.
Lighter work for pitmen.
Saves from 2 to 4 pitmen and sometimes more.
Can travel and work on approximately same character of ground as shovel on railroad trucks.
Where shovel on railroad trucks requires blocking under jacks and both rails, when working on soft ground, the shovel on caterpillars requires blocking only under the caterpillars.

This mounting consists in general of two forward caterpillars, replacing the jack arms, and two rear caterpillars mounted under the read end of the shovel.

The front caterpillars are so designed that they can swivel and adjust themselves to unevenness of the ground. Both front caterpillars are drivers.

The rear caterpillars consist of two caterpillar units mounted on the same frame. They are designed with sufficient strength to permit the crossing of holes and ditches without the delay incidental to filling in.

Steering is accomplished through the rear caterpillars. The massive steering arm is integral with the pintle of the rear caterpillar trucks. It carries a heavy gear sgment which engages a pinion on a vertical shaft It is driven by an independent center valve, reverse type engine, suspended underneath the car frame. This engine may be operated either from the operator's stand or from ground alongside the rear caterpillars. Steering in curves of large diameter can be accomplished by the swinging of the boom without the steering mechanism.

Propelling is accomplished through the front caterpillars. Both caterpillars may be driven together or each one independently, forward or backward. The propelling speed is about half a mile per hour. The tractive power is sufficient to enable the shovel to climb with ease 15 per cent to 20 per cent grades.

For transportation by rail, railroad trucks may be easily substituted.

The Bucyrus Company was the first manufacturer to equip dragline excavators with caterpillars, over eleven years ago; it was the first to apply this mounting to revolving shovels; the first to mount tower excavators weighing over 200 tons on caterpillars; it is now the first to design and build a caterpillar mounting for railroad-type shovels of all sizes.

The mounting of heavy excavating machinery on caterpillars is no experiment with this company.

Well over one hundred caterpillar mounted Bucyrus machines weighing from 65 to 220 tons have been sold within the past eight years and are operating with unqualified success.

Concrete Brick

While cement brick can be profitably manufactured and sold at a price even lower than the common clay brick, they are only approached in quality by the most expensive glazed face and pressed bricks. They have greater compression strength, are more waterproof and through the use of richer facing materials offer the architect and builder a great variety of artistic surface treatments.

As backing or filler brick, they have double the compression strength of the common clay brick, and realizing that concrete brick are a better article and better value, builders and architects are specifying concrete bricks for this purpose wherever they can be obtained. They have seen the common clay variety crack, spall and disintegrate, whereas, concrete brick improve and grow stronger with age.

Sand and cement are easily obtained at very low prices in nearly every locality, so that the manufacturer of concrete brick has a further advantage in quoting delivered prices, especially where clay brick have to be shipped in at considerable expense and loss on account of breakage.

With all of these things in his favor, the manufacturer is assured of a steady demand for his product—a demand that is sure to increase as the superior qualities of his products become better known in his locality.

The first step is to secure a machine that will turn out a brick of the very highest quality and at low

cost. For this purpose The Anchor Concrete Machinery Company, Rock Rapids, Iowa, have, after trying machines of many types, developed the Anchor One-Man brick machine. This simple and substantial brick machine can be furnished with power tamper or with automatic hand tamp device. Making ten bricks at each operation, the machine will produce more brick per man than any other equipment. Being a down face machine this will make the very finest-faced and ornamental brick—yet no speed on common brick is sacrificed. Plain wood pallets used. Special pallet release, involving no springs or clips, practically eliminates breakage so common on other machines.

Upon investigation you will find that with this little outfit, or a battery of such outfits, you can produce brick more cheaply than with any large all automatic machine. And at the same time you do not have a large amount of money invested and are not subject to repeated shutdowns on account of necessary repairs.

Bricks are made on the Anchor One-Man brick machine by the tamped process, not pressed. This is the correct way of making products of this kind, as it eliminates all voids and drives out the air pockets, making a solid and stronger brick.

Experienced help is not required. The machine is so simple and easy to operate that anyone can make good brick with but very little practice. There is only one lever to operate. Every wearing part of the machine has been case-hardened, so that it can be used steadily, day after day, with no delays for adjustments and repairs.

The machine is simple in design, durable in construction, swift and economical in operation. It is a complete brick plant in itself, needing no accessories or other equipment, unless possibly a mixer. It makes ten faced or common brick at a time, all exact in size and proportion and having sharp corners.

Some of the largest and most progressive customers have enlarged their business by the addition of a concrete brick outfit. The business is still in its infancy and promises a wonderful future to hustling concrete products manufacturers.

The Service and Engineering Departments of the Anchor Concrete Machinery Co., Rock Rapids, Ia., can assist you in arranging a plant for turning out concrete brick economically or for rearranging your present plant so that this line may be added to your business.

Concrete Farm Buildings

No farm is efficiently equipped unless it has a water tank, a milk house and a root cellar, The Polk System Junior machine manufactured by Polk Genung & Polk, Fort Branch, Ind., makes possible all of these three in one. In structure they are one; in operation they are absolutely separate.

The water tank is, of course, placed highest, so that pressure may be obtained for the dairy and for the house, thus giving the house the advantages of a city water system.

The milk house is cool, sanitary and complete. Combining it with the water tank has many obvious advantages.

A root cellar is a farm convenience often overlooked. A separate storage for potatoes, turnips, beets, onions, carrots and pumpkins insures against loss and makes for sanitation.

The above three-in-one building is one of the most economical structures possible. It appeals to the good sense and economy of every progressive farmer.

Circular monolithic concrete buildings are rapidly "winning out," because they mean the "most for the money." Circular design gives a maximum of space with a minimum of material. That at once lowers construction costs. Round buildings require less labor to build—another lowering of construction costs. They conserve room, being easily adapted to difficult locations.

Concrete makes it easy to build under ground. It keeps water out or it keeps water in, and it never decays. It makes going to greater heights above ground possible, again conserving space. Concrete is proof against the ravages of time and fire. It keeps out rats and vermin. It needs "never a penny" for repairs. Circular monolithic concrete buildings are substantial and picturesque. They are signs of prosperity and permanence.

The Polk System Junior machine shown herewith has a big program of usefulness in farm building construction. It puts many kinds of circular farm buildings, built for keeps, within easy financial reach of the average farmer. It builds stock tanks, silos, water tanks, corn cribs, cisterns, garages, and well houses at remarkably low cost and in remarkably short time. The Polk System Junior machine is equipped for the erection of circular monolithic concrete structures 10, 12 and 14 feet in diameter, and up to 40 feet in height, with walls four inches thick.

Shipment of two No. 24 Rock Crushers making an 11-car train leaving Allis-Chalmers Plant. Weight of two crushers 950,000 lbs., crushing capacity 10,000 tons in 10 hours. This equipment designed and built by Allis-Chalmers Mfg. Co. for Kelley Island Lime and Transport Company, Cleveland, Ohio.

Molds for Double Walls

Universal Cement Mold Co., 224 Villard avenue, North Milwaukee, Wis., is distributing a folder devoted to the portable molds it manufactures for double wall concrete house construction. These are strongly built, light steel molds, fitted with handles, capable of molding a small section of wall at one filling. After filling, the mold is moved along the wall and again filled. Attachments make it possible to pour corners, build bay windows or other angles, make solid walls, or pour chimneys or pilasters. Further information may be obtained from the manufacturer.

AUDITORIUM, of hollow concrete walls (like a thermos bottle) 64x186 feet Built at Bloomer, Wis., by Contractor F. E. Wiseman, Fairchild, Wis., with a Standard set of The Universal Cement Mold Co.'s molds.

"Figure the amount of material, needed to build Hollow Walls, writes the Universal Cement Mold Co., 224 Villard Ave., North Milwaukee, Wis., in the following manner: One yd. of gravel and one bbl. of cement will build 24 cubic ft., therefore, if you build, say a basement of two 3½" walls, with a 2" air space between them, or a 9" thick Hollow Wall, you will use seven-twelfths of a cubic ft. of concrete to each sq. ft. of wall. So one yd. of gravel and one bbl. of cement will build 41 and one-seventh sq. ft. of wall. Compare this system of wall building with any other and you will find it the best, cheapest, and most perfect way known to the building world.

"The reason wood buildings in the past, have been built extensively, is because they were cheapest, (and not because they were best) but by using our system, one can cut the price in two and obtain many times better results. For proof, read the comparison sheet.

"If your business is such at present, that you do not care to invest in a complete set of molds, buy a No. 6 Combination Mold—Price $48.000. Try it out to your own satisfaction, if it fails in any way to do all we claim for it, we will be pleased to refund your money."

Sullivan Rotators Rock Drills

The Sullivan Rotator may fairly claim to be an "all around" rock drilling machine. Since its introduction, some eight or ten years ago, as an improved type of hammer drill, its use has rapidly extended to nearly all kinds of rock drilling work, including blockholing and cutting hitches; shaft sinking, and a great variety of down hole drilling; drifting, stoping, and even light tunneling; work in hard and soft rock, ore and coal, in quarries and mines, in road grading, in sewer trenches and in heavy open cut work.

The Rotator manufactured by the Sullivan Machinery Co., 418 Peoples Gas bldg., Chicago, is a "one-man "hammer drill in the fullest sense, weighing from 29 to 40 pounds. It is equipped with automatic steel rotation, is built in separate air and steam types, and may be used as a hand tool or on a mounting.

Rotators drill holes from eight to twelve or more feet in depth, for 1¼-inch powder, and are available in several models, to suit varying conditions.

Sullivan Drills have been leaders in educating the rock drilling public to the advantages of greater cutting speed, of reduced weight, and of increased power economy. The "one-man" piston drill for mining, the light "plug" drill for granite quarries, the air feed stoper, the air-jet sinker and the Rotator itself, all have marked important steps in the progress of rock drilling efficiency. While the "Rotator" in its present form was placed on the market about nine years ago, a Sullivan Hammer Drill with automatic bit rotation was used in the Vermont granite quarries as early as 1906.

Sullivan Mounted Water Hammer Drills, for drifting and heavy mining work, Sullivan Stopers, Plug Drills, and Hyspeed and Liteweight Piston Drills are described in bulletins, which will be mailed upon request.

Leading charcteristics of Rotators may be summarized as follows:

1. Automatic rotation of drill steel.

2. Air or steam operation (in separate types).
3. Drill steel retainer.
4. Automatic lubrication.
5. Automatic ejection of cuttings from drill hole.
6. Cushioned return stroke.
7. Adaptability to use on mountings.
8. Simplicity and convenience.
9. Drilling speed and power.
10. Strength, stability and low upkeep cost.

Know Your Sand!

The American Society for Testing Materials has reached the conclusion that the presence of organic impurities of a humous nature is responsible for most of the defective sands that are used in concrete work. They have devised a simple and inexpensive test that can easily be made by anyone.

Sufficient apparatus consists of several twelve-ounce graduated prescription bottles and a three per cent solution of sodium hydroxide, all of which can be purchased at most any drug store for less than $1.

The test consists of shaking the sand thoroughly in a dilute solution of sodium hydroxide (NaOH) and observing the resultant color after the mixture has been allowed to stand for a few hours. To make this test proceed as follows:

Fill a twelve-ounce graduation prescription bottle to the four and one-half ounce mark with the sand to be tested. Add a three per cent solution of sodium hydroxite until the volume of the sand and solution after shaking, amounts to seven ounces. Shake thoroughly and let stand for 24 hours. If the solution resulting from this treatment is colorless oh has a light yellowish color, the sand may be considered satisfactory in so far as organic impurities are concerned. On the other hand, if a dark color solution is produced, the sand should not be used in high grade work such as is required in roads and pavements, or any building construction.

Much of the poor looking concrete to be seen around the city is due, no doubt, to the organic impurities and excessive silt to be found in the sand which is obtained from branches or from points on the sand bar removed a considerable distance from the main channel of the river and therefore not properly washed. A certain amount of silt can be permitted but too much is just as bad as too much organic matter. The cheapest material is often the most expensive in the end. Kolesch & Co., 138 Fulton St., New York, N. Y., will gladly send any of our readers, without obligation, a booklet describing the "Universal Sand Tester," a simple device for testing sand. You can produce stronger concrete at lower cost, if you know your sand. This device can be used in the laboratory, at the pit, in the plant or out on the job.

Otkon Manufacturing Co., 235 Broad Bldg., New Kensington, Pa., manufacture the Debay block molding machine, which produces 12 concrete blocks per minute (8x8x16) or 720 per hour. The only block machine having stationery core bars and rotating mold members.

Machine Mixed Mortars

In most instances mortar and plaster are mixed by hand in the same way as our forefathers prepared their material. There are, of course, different ways of mixing or proportioning. Some builders prefer to use the neat paste and add all the sand at the time of mixing. Others store the paste with a portion of the sand added, while some add all the sand as soon as the lime has been slaked and then merely temper the mixture as required with water.

Hand-mixing is a slow and back-breaking process. Much depends upon the skill of the mortar man as to how thoroughly it is mixed and how well the hair is distributed through the batch when it is used. Many of the larger contractors are now making it their practice to use mechanical mixers for all their work.

Machine mixed mortar and plaster is entirely satisfactory. It is thoroughly mixed and uniform in texture. There are a number of machines specially designed for this class of work, and they have demonstrated their suitability. Some contractors have a mixer in their storage shed and mix their mortar and plaster there, shipping it by truck to the job. Others move the machine from job to job and do the work

The Kent Mortar Mixer.

as it is needed. Both methods have their advocates, and both are satisfactory.

One of the most popular mixers for mortar and plaster and which is universally used is made by the Kent Machine Co., Kent, Ohio.

Steel Belt Conveyor

About twelve years ago the Sandviken Steel Works, a long established Swedish concern, began making steel belts to be used for conveying purposes, and today it has 1,300 installations to its credit. The company is now in a position to meet the demands of the American market. Among its many applications this belt is employed in conveying cement, sand, crushed stone, etc.

The Sandvik belt is made from the best Swedish charcoal steel, cold rolled, hardened and tempered by a special process. Its surface is hard, smooth and dense, giving the belt great durability. When installed as a conveyor with standard size pulleys the belt is subjected to a working stress of from 28,000 to 30,000 lb. per sq. in. when traveling. By special methods of heat treatment, hardening and tempering the Sandvik acquires better rust-resisting qualities than common cold-rolled steel of similar composition.

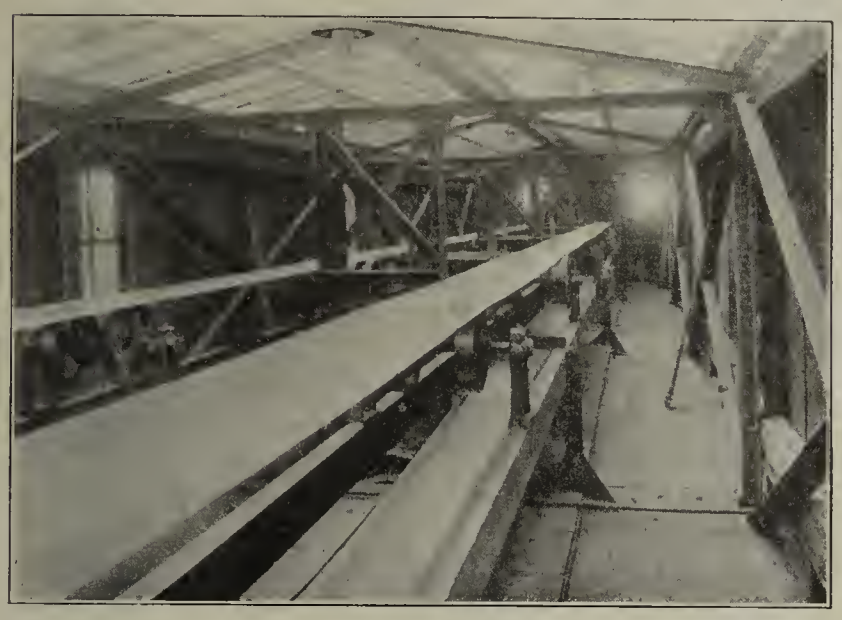
Compared with flat rubber belts of the same width, the steel belt is said to possess greater transverse rigidity and higher capacity, as the edges, even with a one-sided load, do not yield in a downward direction. This allows a relatively broader bed on the belt to carry the load. The steel belt is less flexible than the textile fabric and therefore two-thirds of the width may be used without danger of spillage—the belt is smooth running.

A special feature is the ease and simplicity with which material can be discharged at any desired point along the conveyor without using cumbersome and

expensive trippers. The belt does not stretch and the tension devices are therefore simple as they only have to take up trifling length variations caused by changes of temperature.

Sandvik flexible steel belt can be obtained in one-piece lengths up to 300 ft., 16 in. wide and 0.035 in. thick. The lateral deviation does not exceed 0.03 per cent.

The conveyor is designed either with the conveying



Steel Belt Conveyor handling clinker and crushed stone.

strand sliding on a wooden support—sometimes fitted with trough-like skirting boards, the return strand being supported on idlers—or else both band strands are carried on rollers. The sliding type, with or without skirting boards—extensively used in Scandinavian countries—has little or no wear even for conveyors of considerable length, as the band surface soon acquires such polish that friction and power consumption are almost negligible.

With heavy, hard and abrasive materials the roller supported type is preferable, the materials being placed centrally on the belt and the edges left free, as with flat band conveyors. As steel belts cannot be troughed like textile bands, this is partly compensated for since the flat steel belt has a wider loading area.

The additional advantages of the steel belt have widened the field of usefulness for the belt conveyor, says the Sandvik Company, and should be welcomed by those interested in the handling of materials as the ideal system of conveying.

Sandvik Steel Co., Inc., Woolworth Bldg., New York, N. Y., have just issued a new 26-page booklet, concerning steel belt conveyor installations, which is now ready for distribution. Write for copy.

Rotary Kilns Coolers, Autoclaves, Etc.

The Bonnot Company, Canton, Ohio, have just issued a bulletin describing and illustrating their rotary kilns, coolers, autoclaves, etc., which they are sending to interested parties.

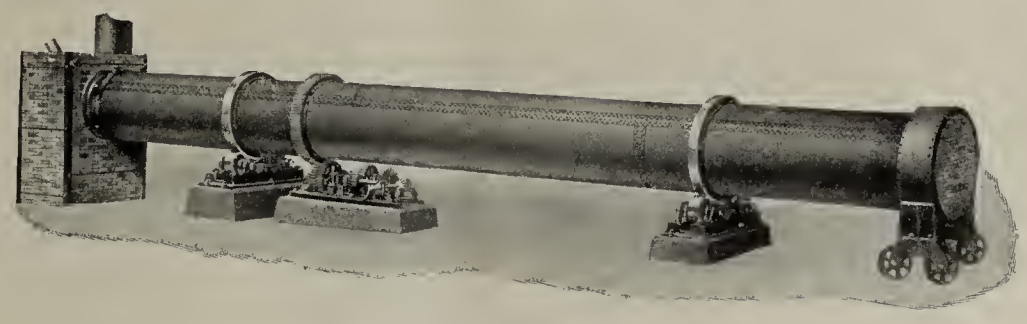
There are many special features and conveniences in the design of Bonnot rotary kilns, which simplify the operation and reduce up-keep. The re-orders received from their customers are ample testimony of the satisfactory service their equipment has given.

The Bonnot rotary kiln was originally designd and manufactured for use in the portland cement industry In later years, it has been used extensively in other fields, notably by oil refineries, limestone, alkali and chemical companies.

Standard Bonnot rotary kilns, are made in sizes up to 8 inches in diameter and of any required length. Special experimental kilns of laboratory size, autoclaves and other cylinders of unusual dimensions can be furnished to specification.

Where it is necessary to cool material after discharge from kiln, the Bonnot rotary cooler can be used. This cooler is sturdily constructed, embodying all the features of design found in the Bonnot kiln.

Some users of Bonnot rotary kilns are, viz: U. S. Bureau of Mines, Aluminum Company of America, Meridian Petroleum Co., Standard Oil Company, Ohio Valley Refining Company, New England Lime Company, Missouri Portland Cement Company, Diamond Alkali Company, Tidewater Oil Company, Norton Company, U. S. & Cuban Allied Engr. Corp., Michigan Alkali Company, Canada Cement Company, Transcontinental Oil Company, Cabin Creek Refining Company, Vacuum Oil Company, Penna. Salt Company, Diamond Portland Cement Company, Columbia Chemical Company, Humble Oil & Refining Company, Kennedy Refractories Company, Champion Fibre Company, Cementos Hidalgo, Mexico, Marland Refining Co., Union Carbide Company.



Bonnot Rotary Kiln.

Portland Cement Specifications

The "Specifications and Tests for Portland Cement," for which the American Society for Testing Materials is sponsor, have been advanced to the full status of "American Standard" by the American Engineering Standards Committee. These specifications, which have been developed as a result of the experience of the industry through several years, were first approved by the A. E. S. C. as "Tentative American Standard" in 1919. They were reapproved in 1921 after agreements had been reached which eliminated slight differences between the Government and the commercial specifications, resulting in nationally recognized uniform specifications.

News of the Cement Mills

The report made at the annual meeting of the Bessemer Limestone & Cement Co. showed the operations of the last year to be most satisfactory. The company shipped 750,000 barrels of cement during the year and the operations of the plant indicated that the capacity could be increased to 1,100,000 barrels.

The company recently placed on the market $750,000 of 8 per cent convertible notes through the Realty Security & Trust Co., and the Valley Investment Co., which have been rapidly taken and will produce a large fund for extended operations.

The directors and officers were re-elected as follows:

Directors—Joseph G. Butler, Jr., chairman; John Tod, R. C. Steese, F. R. Kanengeiser, Fred Tod, John Stambaugh, J. R. Rowland, I. M. Scott, Henry A. Butler, G. G. Treat.

Officers—John Tod, president; R. C. Steese, vice-president; F. R. Kanengeiser, vice-president and general manager; G. G. Treat, secretary and treasurer.

Some time ago it was noted in the Iola, Kansas, Register, that the Lehigh Portland Cement Company had asked all of its various plants to enter into what they called a "no accident" contest—the purpose, as the name would indicate, being to see which plant could get through a thirty day period with the fewest number of accidents. The plants all over the country took up the contest and the remarkably good results which were shown at the end of the first thirty days have prompted the Register to inquire further into the matter to find out how the scheme is progressing now. A report very kindly prepared by C. E. Russell, Chief Clerk, shows a most unusual and remarkable record.

During the first five months of 1921 (before the contest started) the Iola mill had recorded 45 "lost time" accidents. The actual days lost by these forty-five men totaled 440. It seems almost beyond belief that this record could be changed to an absolutely spotless one, but that is what has been done—not only for the first thirty days, but up until now. The co-operation of all the employes with a "Welfare" department has made this possible. Only one other plant of the whole string is still in the running with the Iola mill. (Iola Register)

Another large industry will be added to the many plants now in the Birmingham district when the new 1,000,000-barrel cement plant, which is now in the process of being financed by a concern of Nazreth, Pa., is completed at Village Springs, near Birmingham, Ala. The new plant, it is stated, will cost $3,000,000.

Indications that work will soon start was contained in articles published recently in leading trade publications, which are as follows:

"White Star Cement and Coal Company, of Birmingham, main office Nazreth, Pa., has organized with $3,000,000 capital and plans building of a 1,000,000-barrel cement plant at Village Springs.

"Officers of this company are A. G. Connolly, president; Charles W. K. Shafer, secretary; G. A. Schneebel, treasurer.

"Richard K. Meade & Co., 11 East Fayette street, Baltimore, Md., are the engineers.

Nazreth Cement Company and the Dexter Cement Company are both located at Nazreth, Pa., and it is understood the latter company is interested in the new enterprise planned for Village Springs.

Village Springs is 21 miles northeast of Birmingham, a few miles beyond Mt. Pinson. It is in Blount County, being situated on the county line. Village Springs is located on the Louisville and Nashville Railroad.

Twenty workmen have been employed by the Wolverine Portland Cement Co., during the week to start repairing and improving the plant at Quincy, Mich., with a view to opening the factory for production early in the spring. Among the repairs contemplated will be a new roof for the entire factory. The plant has suspended operations for the winter but officers of the company are looking for a busy and successful season.

The Bessemer Limestone & Cement Company, Youngstown, O., has increased its capital stock from $1,500,000 to $2,500,000. The company operates a cement plant with a capacity of 1,200,000 barrels annually, and has a limestone reserve of more than 60,000,000 tons from which it supplies blast furnace flux; agricultural limestone and road metal.

The new power plant system at the Ash Grove Lime & Portland Cement Co., Chanute, Kans., will cost close to half a million dollars and the plant will have to shut down during February, until the first of April, for the change from the power plant now being used to the one being installed.

In anticipation of the shutdown the company has filled its storage bins to their capacity of 200,000 barrels and is piling about as much more on the ground in the shape of clincker, so as to be ready for the revival of business expected to develop in the spring and early summer.

The company employs 350 men and has expended a million dollars in improving its plant here in the past four year, Mr. E. J. Sunderland, superintendent, stated. He have an interesting account of the organization of the force of 350 and the various processes in the manufacture of cement. "The plant," he said, "has been in operation for fourteen years continuously, except when temporary shutdowns were necessary for repairing and overhauling. There is but one other cement plant in Kansas that has made a similar record. The Ash Grove Company adhere to the policy of steady production because it believes it is most economical."

The company has a gas system with more than forty miles of pipe, extending to the other side of Earlton and beyond Humboldt, he said. The loss of gas through the mains is less than 1½ per cent. This is very slight, and Mr. Sunderland explained that the company welds its line.

The fuel consumption is 200 tons of coal and 2,500,000 cubic feet of gas a day, the coal being ground and used under the kilns, and the gas being used to heat the boilers. If crude oil were used in place of gas consumption would be 1,200 barrels a day, he said.

1/3 more per dollar

Will not freeze in any weather

DUMORITE—the new Du Pont dynamite which gives you over 1/3 more work for your dollar—is *non-freezing*.

By rigorous laboratory tests and extensive field operations we find that Dumorite can be shot successfully at any temperature. It is just as good in below-zero weather as in the summer time.

Stick for stick, Dumorite does approximately the same work as 40% dynamite, but you can buy 135 to 140 sticks of Dumorite at the same price as 100 sticks of "40%." And Dumorite is a guncotton-nitroglycerin dynamite that will not cause headache.

Dumorite is being used successfully in most kinds of explosive operations. Write our nearest branch office giving details of your particular work and let our Service Department solve the problem of fitting Dumorite to your job. Let Dumorite reduce your explosives bills for 1922.

E. I. du Pont de Nemours & Co., Inc.

Explosives Department

Wilmington, Delaware

BRANCH OFFICES:

Birmingham, Ala.	Denver, Colo.	New York, N. Y.	San Francisco, Calif.
Boston, Mass.	Duluth, Minn.	Pittsburgh, Pa.	Scranton, Pa.
Buffalo, N. Y.	Huntington, W. Va.	Portland, Ore.	Seattle, Wash.
Chicago, Ill.	Kansas City, Mo.	St. Louis, Mo.	Spokane, Wash.
	Springfield, Ill.		

Du Pont Products Exhibit
Atlantic City, N. J.

NON-HEADACHE DU PONT NON-FREEZING

DUMORITE

News of the Concrete Products Factories

Concrete and reinforced concrete construction will be used throughout the new ten-story office building which the Canada Cement Co., Ltd., are erecting in Montreal. The facades on the three streets will be hand-tooled cast-granite stone made by the Benedict Stone Corp., and the south wall an dcourts will be lined with "hydro-stone" made by Canadian Hydro-Stone, Ltd.

You know what a dirty, disagreeable job it is to properly bundle your empty cement sack for returning to the manufacturers. They are worth a dime a piece so you can't afford not to return them, but the job is put off from time to time because no one likes to do it. And after they are tied, if you do the work by hand, you have a loose, awkward bundle that don't handle well and out of which sacks can be pulled by freight handlers thus resulting in shortage annoyance and bothersome adjustment. Why not do the work in a clean, quick, easy, business-like manner? Your returned cement sacks will stamp your place as an up-to-date progressive business firm if you bale your sacks with a sack baler machine. Saves time and labor, dirt and bother. Write for prices and further information to Handy Sack Baler Co., 620 2nd St., Cedar Rapids, Ia.

H. D. Conkey & Co., Mendota, Ill., have placed upon the market new and very efficient cement tile and block car in single, double and triple deck types, with rigid or folding decks. The Conco cars are strong, easy running, easy to load and moderate in price.

A specialty of porous, hard faced, and thoroughly waterproof cement blocks is being made this year by Abbott Brothers, 919 Enos avenue, Springfield, Ill., who manufacture the blocks in their own plant by their own process.

A prejudice of long standing against cement blocks as a building material has been founded upon their tendency to absorb water. This new hard surface block, according to Sam E. Abbott, is perfectly waterproof. It is being used for foundations and is especially adapted to garage construction.

B. C. Benson, building tile and concrete block manufacturer, Peterson, Minn., has just had his new block tested as to its strength at a research laboratory in Chicago, and received a most flattering report. The tests show that the block will hold the enormous weight of 82,400 pounds, or 1,980 to the square inch.

About a year ago the Sunshine Homes and Concrete Products Co., Bridgeport, Conn., leased a 40-acre former shipyard in this industrial city and converted it into a manufacturing plant consisting of traveling cranes, concrete mixers, woodworking mill, plumbing and paint shops and delivery equipment. The output of the plant when fully equipped is to be four concrete house units per day and delivery is being and is to be made within 50 miles of the factory, without extra charge.

The traveling concrete machine or gantry which will be the chief apparatus of this plant, is crane-like in appearance with two cement mixers with loading hopper bins above. From railroad cars beneath, the sand and cement is to be lifted in grab buckets to the hopper bins and after mixing poured into the forms.

First the form for the house is constructed of creosoted wood and heavy reinforcing netting is placed to reinforce both sections of the double wall. Next the window and door frames are put into position and the traveling crane moves it to place.

No other roofing made in America is quite like the concretile roof made by the Indiana Concretile Roofing Co., says the Indianapolis News. It has the advantage of being much lighter in weight and appearance than the usual clay tile roofing. It can be used on mansion or bungalow, cathedral or factory and can be had in all the colors necessary to conform to the decorative scheme of the building or site.

The machinery used in its manufacture is made in Indianapolis by the Walter Concretile Machinery Company. The license for use of the machinery in Indiana was sold to the Indiana Concretile Company, of which Joseph Mullane is president.

At the present time the manufacturers are producing at the rate of some 2,000 squares of tile yearly, equal to about 150 roofs annually. The plant has a potential capacity of 10,000 squares a year.

Concretile is made from concrete and the dry color is made a part of the tile, being trowled on and will endure as long as the tile lasts, improving with age. The tile locks, tile to tile, and is laid in concrete and where reroofing is done is laid over the old roof. The company gives a guarantee that a roof laid of concreteile will last as long as the building.

The Indiana company started in a shed some eight years ago. It now occupies a modern plant at 53rd street and the Monon railroad. There are other plants located in Cleveland, Chicago, Louisville, Atlanta, Reading, Pa., Birmingham, St. Petersburg, Fla., and Lancaster, Pa. The capital invested represents $1,000,000 in the 45 plants.

The new roofing besides being beautiful and everlasting, reduces fire insurance rates at least 20 per cent. Under the city fire ordinance, which is changing the character of roofs in Indianapolis, concretile is popular and at least 50 per cent of the new roofs in the city are made with this product.

The Anchor Concrete Machinery Company, which moved a portion of its plant to Adrian, Mich. from Rock Rapids, Ia., early in the year after buying the machine shop of the Adrian Steel Casting Co., is planning to move its entire plant to Adrain, erect an additional building and expand its business.

For the last three months the company has operated on two shifts owing to a rush of business and it is now behind on its orders, H. E. Edmondson, assistant general manager, said last week. The company makes various types of machines used in the making of concrete blocks, brick and tile. Parts of these machines are being made in Toledo and Columbus in addition to Adrian and Rock Rapids. When its new building is completed in Adrian all its manufacturing operations are to be concentrated in Adrian.

The Biography of a Cripple (?)

Suppose you had just installed a 1180 foot belt on an inclined conveyor and a few hours later an accident occurred which ripped the belt four inches for a distance of 360 feet. What would you do? No doubt just exactly what this mill superintendent did—order a replacement belt, and let the cripple run until it gave out.

But, in this case Goodrich "LONGLIFE," the cripple, refused to quit the job—at the FORTIETH MONTH, saddled with two trippers, it was still working away. It had already carried, 2,442,913 tons—and the original estimate before accident was 2,018,000 tons!

"That replacement belt in the cellar will die of old age," said the perplexed plant engineer, "if we don't do something with it soon. What's to be done?"

Being between the devil and the deep blue sea, they removed the "LONGLIFE" belt and put it on short centers and lighter work—*and there it is today, still doing business.*

That's typical "LONGLIFE" service. You want lower costs—here's the belt to help you get them. Try it!

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

Goodrich

"LONGLIFE" *Conveyor Belts*

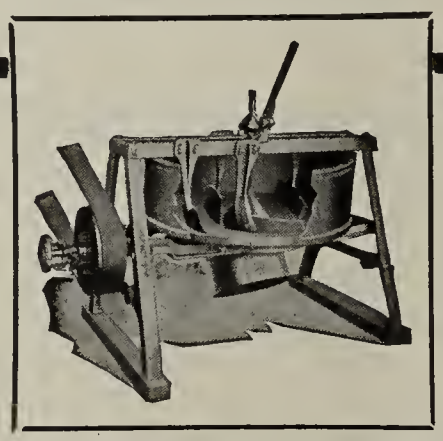
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



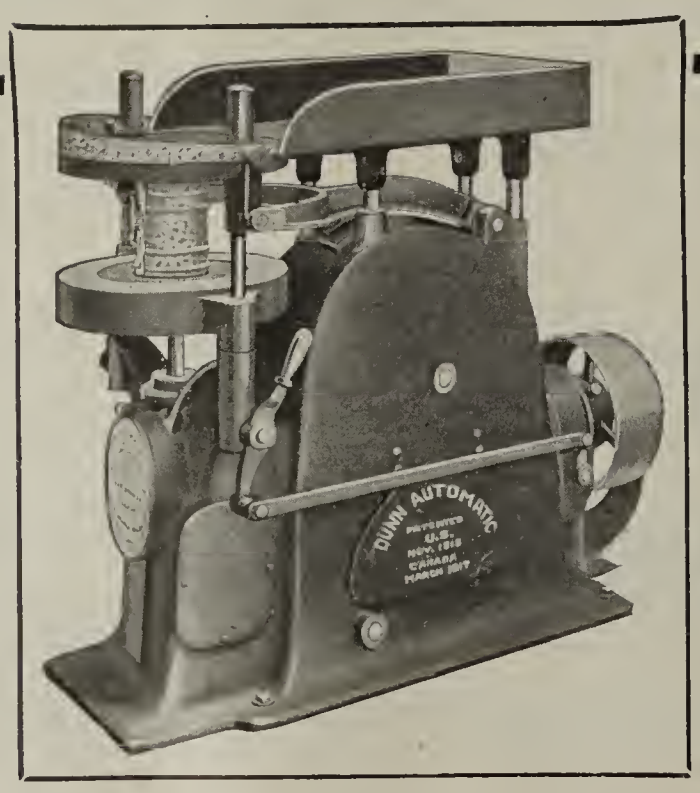
The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

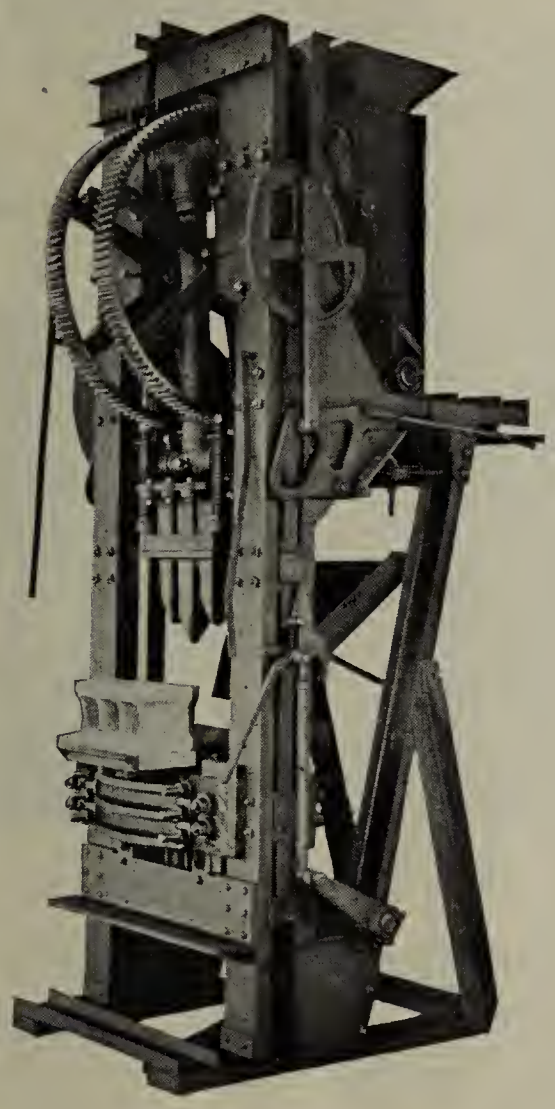
There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

414 W. 24th Street

HOLLAND, MICHIGAN

ATTAINING THE MAXIMUM IN OUTPUT AND ECONOMY



FINALLY NARROWS DOWN TO THE ADAPTION OF THE

Post Economy Punch Block Machine

for large production of quality concrete blocks. It is an automatic machine.

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block.

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

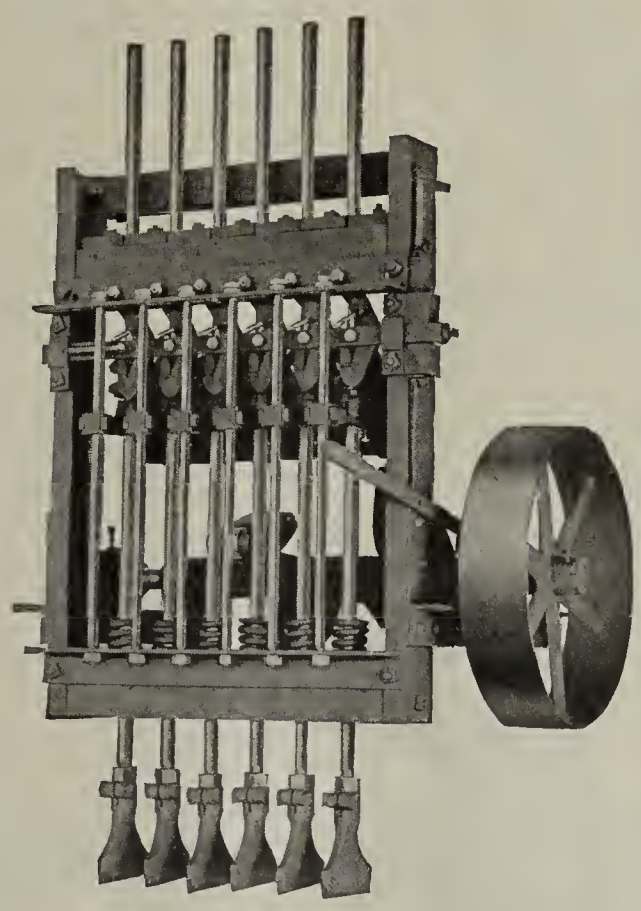
The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.

A Reliable Tamper for the Small Concrete Block Plant

The Kent reliable tamper has a shock absorber on each lifting foot, reducing noise of the lifting blow. It is substantial in design and is guaranteed against breakages due to workmanship and material. It will fit over any block machine.

The machine will not knock itself to pieces as other tampers do. The individual shock absorber looks after that. Long bearings, rugged steel frame, heavy castings, stiff shafting, turned pulleys, means small repair bills.

We are now placing on the market the following machines, to be known as the



RED LINE PRODUCTS

Automatic Tampers	**Lift Trucks**	**Elevating Devices**
Block Machines	**Continuous Mixers**	**Electric Motors**
Block Cars	**Batch Mixers**	**Gas Engines**

KENT MACHINE CO.

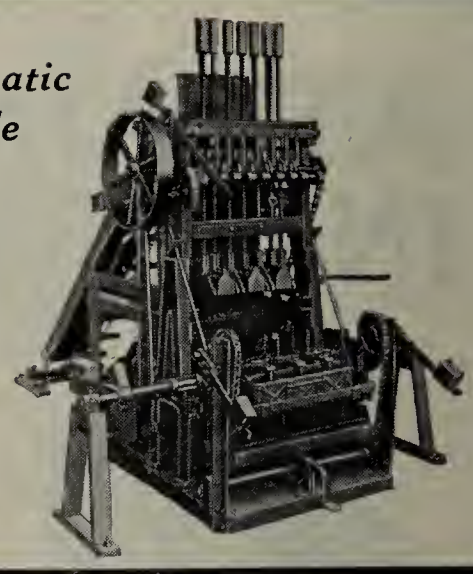
KENT, OHIO

When you buy *Ideal* equipment

you are investing in the time-tried, thoroughly-tested production of a company whose machines and other equipment are used and endorsed by representative concerns throughout the nation. We make only one quality—**the best**—and everything you buy of us is **reliable.**

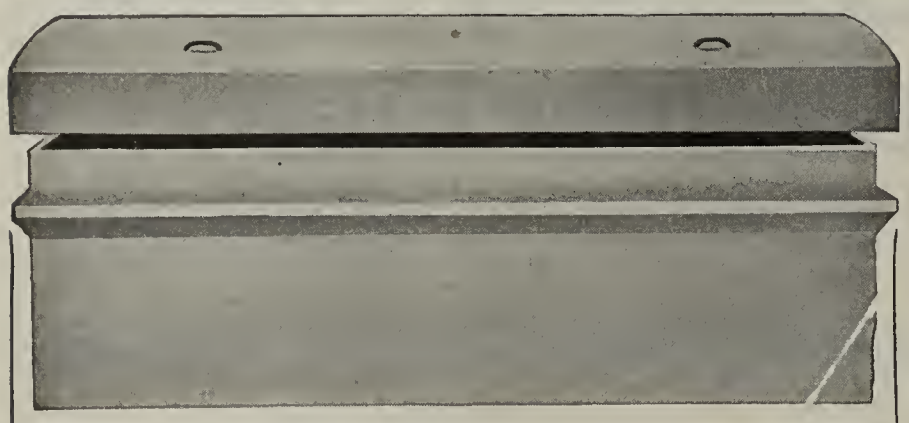
Our Fully-Automatic Building Tile Machine

delivers three tile on a single pallet, with no stopping or delay for off-bearing of tile. Standard size, and a single cycle requires only 22 seconds.



The Ideal Concrete Machinery Co.

1338 Monmouth St. **Cincinnati, O.**



A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.

216 E. River St. **PERU, IND.**

Medusa White Cement for Ornamental Work

Medusa Waterproofed White Cement offers concrete products manufacturers the chance to produce ornamental building trim that is equal in both appearance and durability to carved stone and that can be made and sold at profit prices.

By the use of Medusa Waterproofed White Cement this precast cement work can be made impervious to moisture and protected for all time against discoloration during rains, etc.

Medusa Ornamental Trim identifies your building achievements and serves as a foundation upon which to build further business.

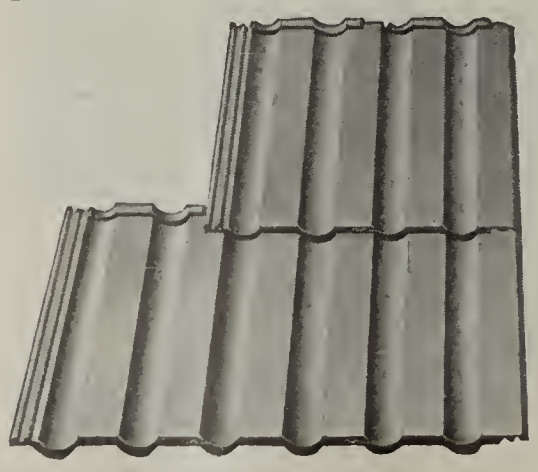
Consult your nearest Medusa dealer or write us for particulars.

THE SANDUSKY CEMENT COMPANY

Department E, Cleveland, Ohio

MEDUSA Stainless White Cement

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

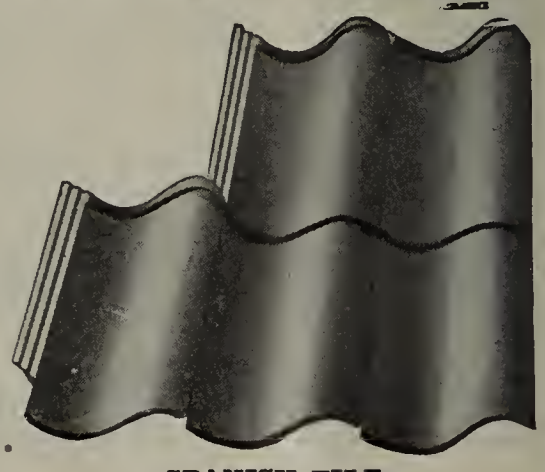
Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name. "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

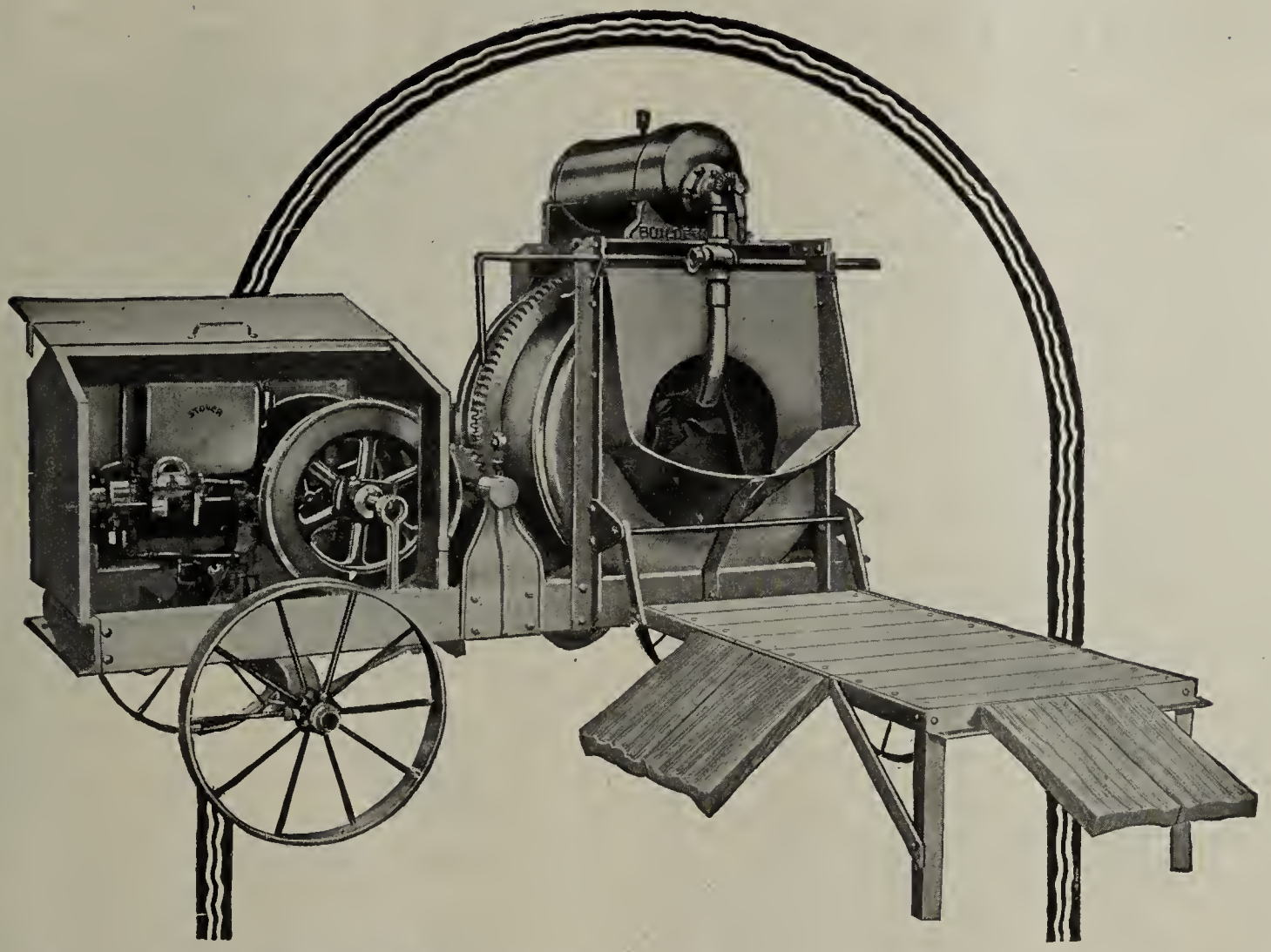
Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.

3617 E. 23rd Street **Kansas City, Mo.**



SPANISH TILE



A BUILT OF STEEL ONE BAG MIXER

At a New Price Everyone Can Afford to Pay

JUST THE MIXER FOR THE BRIDGE BUILDER OR GENERAL CONTRACTOR ON ACCOUNT COMPACTNESS AND PORTABILITY—AN EXCEEDINGLY FAST DISCHARGER WITH ALL STEEL DRUM, EVEN THE TRACKS—WITH BIG RELIABLE ENGINE—FURNISHED WITH POWER LOADER OR BATCH HOPPER ALSO IN ½-BAG SIZE AT $308 COMPLETE

BOSS EQUIPMENT

LABOR SAVERS FOR CONTRACTORS

Used By Over 6,000 Contractors

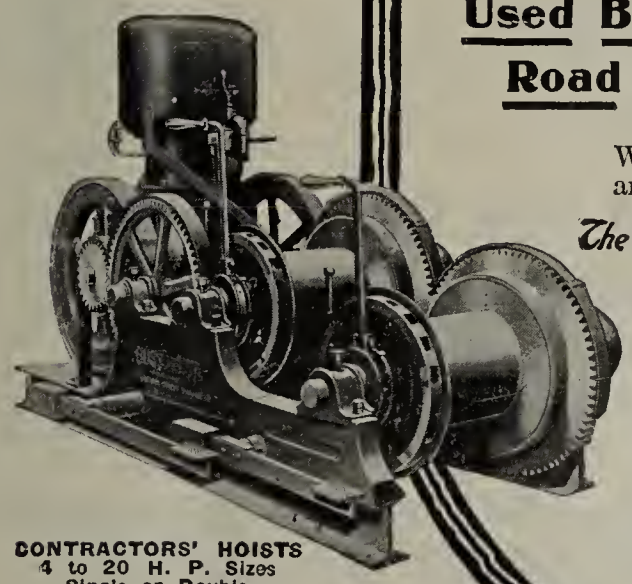
Road Builders and Engineers

Write Today for Our New Catalog and Low 1922 Prices—Also Terms

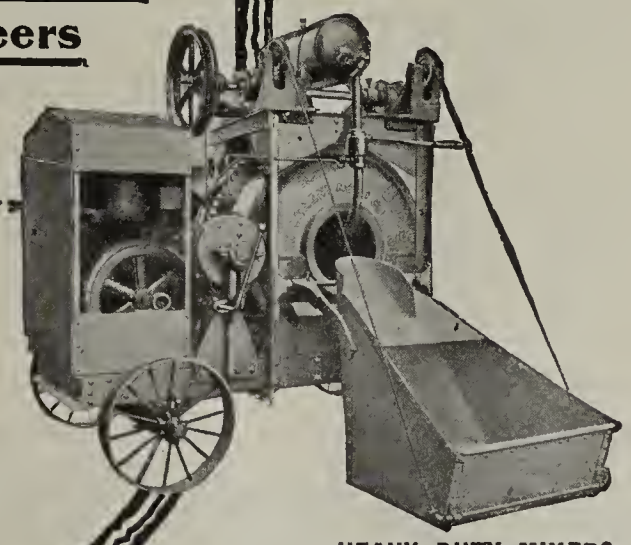
The American Cement Machine Co. Inc.
Keokuk Iowa
THE 300,000 H.P. ELECTRIC CITY

BRANCH OFFICES AND WAREHOUSES

NEW YORK	NEW ORLEANS
CAMBRIDGE (Mass.)	CHICAGO
PITTSBURGH	MINNEAPOLIS
WASHINGTON	DETROIT
PHILADELPHIA	OMAHA
RICHMOND	ST. LOUIS
ATLANTA	TULSA
KNOXVILLE	LITTLE ROCK
INDIANAPOLIS	DALLAS
LOUISVILLE	EL PASO
	LOS ANGELES
	PORTLAND



CONTRACTORS' HOISTS
4 to 20 H. P. Sizes
Single or Double



HEAVY DUTY MIXERS
½, 1, 2, 3, 4-Bag Cap.
Gas, Steam, Electric

Ask About High Speed Alley and Street Paver

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

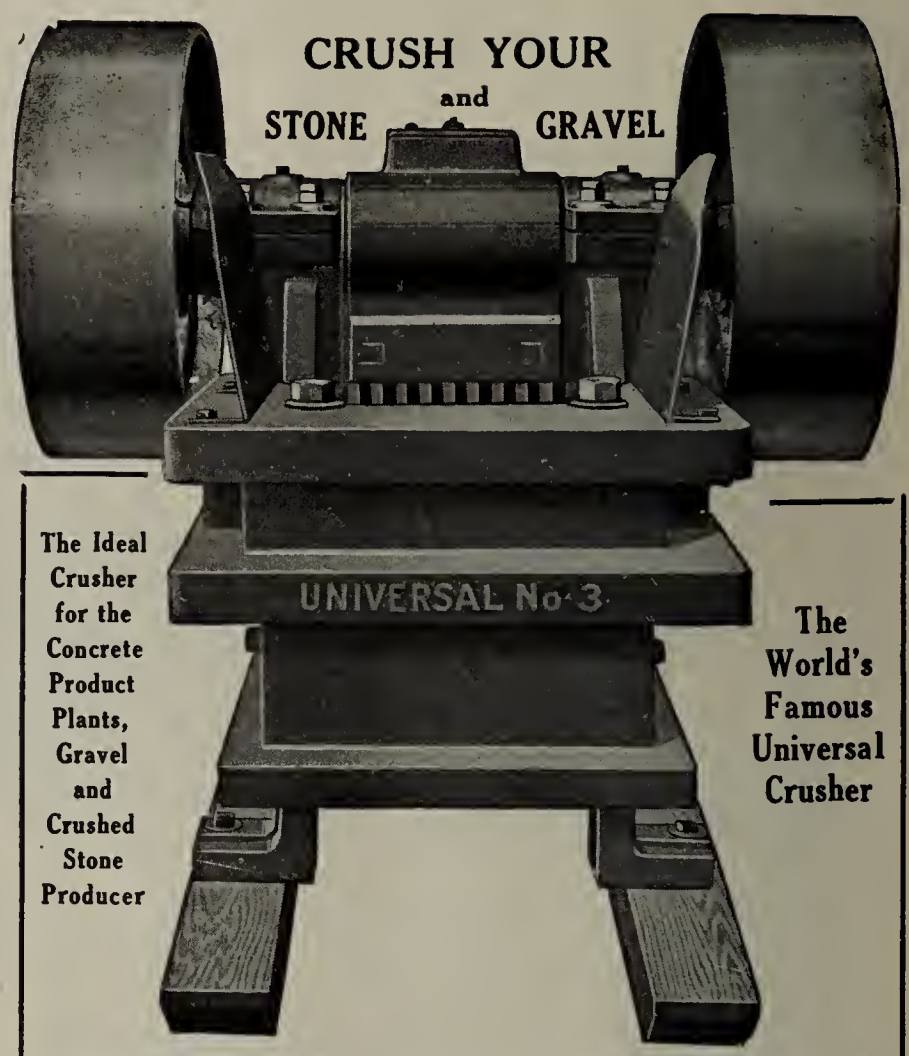
Several great states have so ruled.

American Steel & Wire Company's Concrete Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa, U. S. A.

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

Biggest Mixer Bargain Ever Offered

REMMEL MIXRITE Concrete Mixer

The World's Best 4 Cubic Foot Mixer

All Iron and Steel construction, with the EXCLUSIVE SIDE GEAR DRIVE, that adds 100% to its worth. Mixer loads or discharges from either side—always in gear when dumping. Strongly built—no wobbling.

The Popular Mixer for

MASON CONTRACTORS
Saves 50% in Labor

CONCRETE CONTRACTORS
Large enough for the average job and small enough to be readily moved. A Money Saver.

CARPENTER CONTRACTORS
Just the right size for foundations and floors.

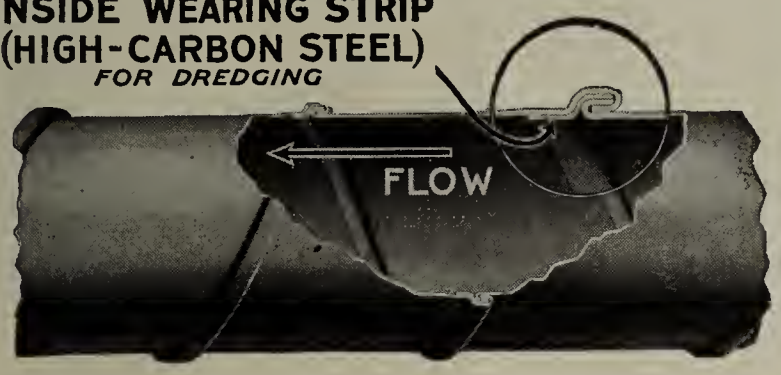
TOWNSHIPS
Just right for culvert and county work.

Sold Under Iron-Clad Guarantee. Write for complete specifications and descriptive circulars. Dealers wanted everywhere.

REMMEL MANUFACTURING CO.

Dept. E Kewaskum, Wis.

NAYLOR *Lock-Seam* SPIRAL DREDGING PIPE

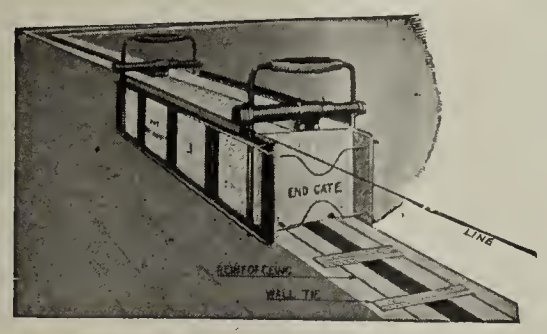


The greatest advance in the manufacture of spiral pipe. It is formed of one continuous strip of very tough Skelp Steel, and is made absolutely water and air tight without the aid of rivets or the use of pipe coating. Has double the life of any other.

If you are interested, we will be pleased to send you, at our expense, a small section of 12-inch, No. 10 gauge steel pipe; it will demonstrate to you the serviceability and economy of our Lock Seam construction.

ROBERTSON BROS. MFG. CO.
5401 So. Western Blvd. CHICAGO, ILL.

For 50% Build the Hollow Wall Way For 50%



Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

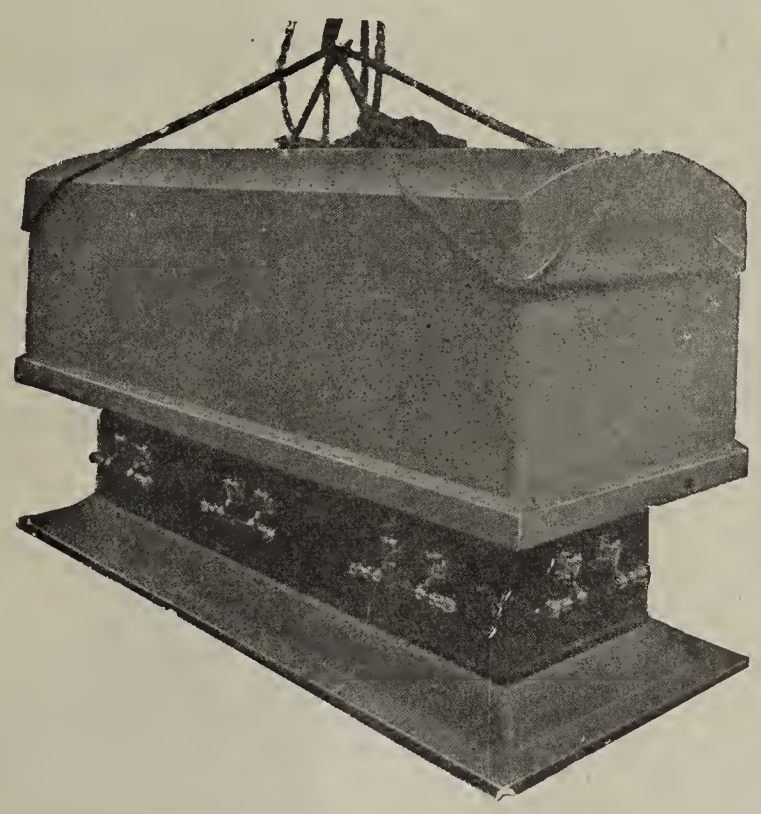
make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.



GEO. ZIEGELE
215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE" (Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples
VICTOR BALATA & TEXTILE BELTING CO.
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston
CONVEYOR BELTS A SPECIALTY

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration. S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

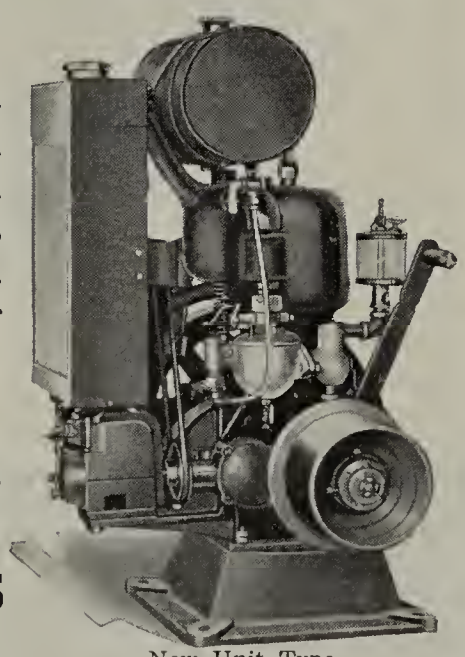
Sauerman Bros., 1139 Monadnock Bldg., Chicago

Your Machine Will Deliver Better Service With a

CUSHMAN

Light Weight Heavy Duty Engine

Over 50,000 in successful service. Sizes, 1½ to 20 H.P. Let our engineers work with you. Write us your power problem.



New Unit Type
4 H.P. CUSHMAN
Weight, complete, 230 lbs.

CUSHMAN MOTOR WORKS
821 N. 21st St.
Lincoln Neb.

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

POWER DRAG SCRAPER

The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN
907 Lumber Exchange Bldg. Chicago

Cement and Engineering News

Vol. 34 Chicago, JULY, 1922 No. 7

Solving the Problems of the Portland Cement Industry

What the Portland Cement Association Is Doing To Improve Cement and Its Ultimate Product, Concrete

By F. W. Kelley

Chairman, Committee on Technical Problems, Portland Cement Association

It is now almost one hundred years since portland cement was invented. It is now manufactured in almost every country in the world. It is made from a great variety of materials, all of which, however, contain the essential ingredients of lime, silica, and alumina, combined invariably with other ingredients, such as magnesia and iron, and smaller quantities of rarer elements.

The methods, processes, and machinery for handling these diverse raw materials and converting them into a product which can be relied upon to give substantially similar results when used in concrete, are as diverse as are the materials. No two cement manufacturing plants are alike, although as the result of experience and through the establishment of standards, it has been found possible to reach by an almost infinite variety of means, a substantially uniform end.

Specifications—In every country, largely as a result of practical experience, there have grown up specifications which in general place a maximum limit upon the quantities of non-essential materials which may be present, and prescribe certain minimum physical requirements for the product, in order that it may be deemed satisfactory as an article of commerce, and be relied upon to give results consistent with those of past experience.

The specifications for cement in the United States are now a uniform standard, known as Specification No. 1 American Engineering Standards Committee adopted by the United States government departments, by substantially all of the engineering societies, and are guaranteed by cement manufacturers.

The manufacture of portland cement calls for very large capital investment; the capital turnover is less than once yearly; and the power consumption per unit of output is enormous when compared with other industries. By reason of its heavy shipping weight, it is peculiarly essential that its manufacture be conducted as close as possible to the point of use, and it is only because its manufacture has been successfully accomplished throughout all parts of this country, that this convenient building material has been made everywhere available to the user at a per pound price which has been less than that of most manufactured materials of commerce, and comparable with partially treated natural products, like common salt.

Object of the Association—Portland cement when completely manufactured and ready for the consumer is, in its relation of usefulness to the community, a means and not an end. Its useful end is that of an essential ingredient in making concrete. Concrete is a mixture of cement and water, generally combined with aggregates. Concrete may be made by anyone possessing cement, water and aggregates. Good concrete may be obtained only by properly selecting these materials proportioning them rightly, mixing them by suitable methods and for the right length of time, placing them in suitable forms and under appropriate conditions, and protecting and curing them adequately and properly.

The very ease with which the materials may be handled leads to their use. Any one of the active adult population of the United States is a possible user of cement, and the problem facing the manufacturer of the product is not so much that of urging people to use cement, as to use it right. This object has been basic in the organization and development of the Portland Cement Association, and in the work of its several service departments.

A few years' experience in this co-operative service work indicated that so-called practical experience in the use of cement in making concrete was an insufficient basis for development. In almost every case, materials and conditions varied, even laboratory investigations had been generally conducted in such a way that more than one variable had been left uncontrolled. The results of laboratory tests made in different places were frequently inconsistent, and sometimes misleading. The need for further study and a sound determination of fundamentals grew constantly more apparent. Only a determination of the effect of a variation in each of the essential materials and conditions involved in making of concrete, could give us sound knowledge.

Research Laboratory—With this idea in mind, after a number of years' study and consideration of the matter, in December, 1914, a comprehensive report was presented to the Portland Cement Association covering scope and details of a research laboratory, based upon such information as could be obtained from laboratories undertaking somewhat similar work. This report resulted early in 1916 in the arrangement between the Lewis Institute in Chicago and the Portland Cement Association, under which they jointly established and agreed to operate the Structural Materials Research Laboratory under Prof. D. A. Abrams. Much important research work in concrete had aleady been done in the laboratory, and this was continued and enlarged in scope; the physical equipment increased and improved and the operating staff enlarged.

The appropriations of the association for research work which were $3.150 in 1914 increased to $20,000 in 1916 and to $81,000 in 1921, there being a gradual

development, enlargement, and improvement in the work. These are laboratory expenses only, and are in addition to the much larger sums required for co-ordination with field work and for providing the necessary service to the public.

The report of the laboratory in 1919 showed that important information had been gained on—(1) How t omake concrete tests: (2) 7ffect of size and grading of aggregates; (3) Effect of quantity of water; (4) Effect of quantity of cement; (5) Effect of fineness of cement; (6) Effect on wear of materials, proportion and manipulation; (7) Effect of organic impurities; (8) Effect of powdered admixtures, and (9) Effect of time of mixing.

The effect of the work of this laboratory on the knowledge and practice of making concrete is now pretty well recognized by engineers. No claims for originality are made for this work, except that the conditions under whic hit has been carried on have permitted a character of control, a completeness, a comprehensiveness, and a relatedness of tests which have given definite indications and established definite relations which heretofore have been open to question. It has had a profound effect not only in increasing the quality of concrete, but in decreasing its cost.

Economist Bearing—From time to time questions have arisen as to certain inherent features of a given cement which affect its quality. For instance, there was a time when increased fineness of grinding of cement was advocated as a means of improvement. Most careful researches were made into this phase of the subject, and it was established that an increase of strength of about 1 per cent resulted from each 1 per cent increase in fineness. It was also found that 1 per cent increase in strength resulted from the use of 1 per cent more standard cement and that the increased strength gained by the use of more standard cement cost much less than when gained by using finer ground cement. The reason for this is quite evident when it is realized that the present cement of commerce is ground to within about 10 per cent of the practical ultimate fineness, and that the decrease in output of grinding mills and the increased cost of grinding grow rapidly greater as we increase the fineness toward this ultimate. All such questions have an economic bearing and while increased fineness is recognized as a ultimate refinement, there appear to be other matters pertaining to its use, requiring more immediate attention.

The experiments show that a variation of over 100 per cent frequently results in strength of concrete from variation in the quantity of mixing water used, while variations of almost equal importance follow changes in the quality and proportion of the aggregates, in the time and manner of mixing, and in methods of placing, handling, protecting, etc.

It must appear evident that the additional cost of grinding at extreme limits is so great that it will only be justified as an extreme refinement in cement making, after the practice of using cement in concrete has been brought to a point where the effect of such refinement will be secured in the quality of concrete.

Constitution of Cement.—Questions have also arisen as to the effect of variations in the chemical constituents of the cement. These relations are so complex that notwithstanding some fifty years of research on this problem which is capable in many of its aspects, of attack by individual chemists and experimenters, there is still much which is the subject of controversy and offers a field for a vast amount of research work.

While interesting, much of the information to be gained by such investigations must remain academis, although it must be recognized as offering possibilities for better knowledge of the material and its improvement, and its pursuit continued parallel with the more practical aspects of the subject. Portland cement to be useful must be relatively cheap, and this means ability to produce from essential materials, existing in combination with other non-essential materials, in as widely distributed locations as possible. It seems probable then that the most immediately useful research in this aspect of the problem will be the study of how portland cement, having the necessary characteristics of strength and permanence when used in concrete, may be made from as widely diverse materials as possible.

Improvements in Manufacture—Because this problem is to a large extent individual, it has heretofore been studied chiefly by individual manufacturers as applied to their individual operations. Most manufacturers while perhaps not knowing fully all and each of the complex chemical reactions and combinations which take place, yet generally understand the proportions and methods which will result in making from their particular materials a product which measures up to the standards developed by experience and research, and tested by time. The advancement and improvement in methods and processes to secure uniformity, as well as quality of product, have been steady and marked.

The process of manufacture is an exact chemical-mechanical one in which conditions must be maintained within narrow limits and with large quantities of materials.

Each plant must and does work out the best methods for handling efficiently its particular raw materials so that they may be supplied in a continuous stream of uniform and proper chemical proportions and in suitable physical condition, to furnaces in which uniform white heat temperatures must be maintained, so that the resulting clinker, of a hardness after cooling, capable of scratching glass, may by gradual reduction be brought to a fineness of at least 78 per cent through a sieeve having 40,000 meshes per square inch, and exceed all other rigid requirements of the standard cement specifications.

A considerable amount of difference of opinion in many matters relating to cement and concrete has existed because the nature of the problems presented made extremely difficult the application of methods of precision.

Public Service—In order to make effective and readily available to the cement using public, the results of the work of the Structural Materials Research Laboratory as well as to put that laboratory into practical touch with the problems of the cement user, which is necessary if laboratory work is to avoid becoming academic, there have been established by the Portland Cement Association twenty-four district offices, placed conceniently accessible to consuming centers, each in charge of a qualified district engineer supplied with a suitable trained engineering organization.

The keynote of association work has been service based upon the facts provided freely to all.

The manufacturers of Portland cement found themselves making a product which was apparently simple and easy for anyone to use, and which because of its flexibility, convenience and merit was being widely adopted. Given the most perfect cement which could be made, this very convenience and ease, where not coupled with the necessary skill and knowledge, brought results which were unsatisfactory and sometimes even dangerous. The industry therefore ad-

dressed itself to the proble mof directing the attention of all users to the necessity of learning how to use cement, and making readily and conveniently available, the necessary information to all inquiries. To do this, required the direction of attention to the product itself, its manifold uses, as well as its frequent abuse, and provision for the necessary organization to reach the widely distributed people in this entire country.

Attention has been directed toward those factors of concrete making in which there was the greatest need and opportunity for improvement, just as attention has been brought particularly to those forms of construction for which there existed the greatest need, and for which the material offered the greatest advantage.

Future Developments—As the work develops in its different lines, it is expected that it will cover all phases of the subject in greater detail, and it is hoped that the practice of concrete making will become so well understood and so perfectly carried out that further refinements will be possible in all its elements, not excluding cement. Cement is, however, probably nearer its ultimate possibilities as now apprehended than are any other elements of concrete making, but no man could today, in view of the constant advances of knowledge, say what are its ultimate possibilities.

The very existence of the cement industry and each individual manufacturer depends upon providing cement which is of high quality and suited to the conditions existing.

The average quality of concrete is improving. The knowledge of cement and cement making is improving. If the art of concrete making reaches a point where any change in portland cement is an economic advantage, if it is possible to provide such cement, it will of necessity be offered by the manufacturers.

The end sought is better and more concrete, and wider demand for portland cement by satisfied users. In this way only can the industry build soundly for the future and justify its slogan "Concrete for Permanence."

Cost Accounting

A better understanding of the purpose of cost accounting to make it more useful to the business man was advocated in a speech here by Arthur Lazarus, of the Chamber of Commerce of the United States, before the Industrial Division of the Cleveland Chamber of Commerce.

"Much remains to be done to make cost accounting the instrument of service it should be to business," said Mr. Lazarus. "Coupled with the tremendous interest in sound cost accounting is an immense dissatisfaction with cost systems that give results too late for action; that are burdened with excessive details and 'red tape,' and systems that will not function effectively when most needed—in times of adversity.

"Much of the confusion that has arisen in cost accounting is due to the fact that when we use the term 'Cost Accounting' we do not always mean the same thing, and some of the problems which are causing so much trouble, such as the inclusion of interest on invested capital into costs, will disappear when we arrive at a true undertsanding of the purpose of cost accounting. What is meant by cost accounting? Does it mean accounting for the expenditures in a business, ir does it mean a proper distribution of expenses to departments, commodities and processes, or does it mean a procedure to eliminate waste and inefficiency? Or does it mean all of these three things?"

Mr. Lazarus enumerated five outstanding problems which must be cleared up in order to increase the usefulness of cost accounting. They are:

First. Definition of terms.

Second. Formation of cost accounting principles.

Third. Budget making and establishment of individual standards.

Fourth. A better distribution of selling expenses.

Fifth. Making cost results effective, that is, the presentation of cost results in such a way as to get action.

New Book, Business Side of Contracting

McGraw, Hill Book Company, 370 Seventh avenue, New York, N. Y., have just issued this new book which is offered in lieu of a new edition of the author's Cost Keeping and Management Engineering, published many years ago. It is intended for engineers, contractors and superintendents engaged in the management of engineering and construction. Its purpose is to assist them in reducing construction costs to a minimum. To this end the book defines the laws or rules of management, shows how to apply these rules in handling men and in organizing work, explains how to keep records of efficiency and cost, and outlines a good bookkeeping system for engineers and contractors.

"Construction Cost Keeping and Management" by H. P. Gillette, editor of Engineering and Contracting and Richard T. Dana, Chief Engineer, construction Service Company. 572 pages, 5½x8, 264 illustrations, $5 net, postpaid.

Rules and laws of management that show you how to handle men efficiently.

Rcords and suggestions that help you get the most out of equipment.

Plans of organizing construction jobs that have proved successful for others.

Methods of obtaining daily reports that show the efficiency of the men and machinery employed.

Good workable systems of keeping costs.

Practical bookkeeping systems for contractors and engineers.

How to run the engineering office efficiently. These are the things this book discusses. Just one suggestion gained from its nearly 600 helpful pages may save you hundreds of dollars in a single year.

Do you know the eighteen rules for securing minimum costs on a construction job?

Do you know how to measure the output of workmen?

Do you know the best methods of keeping cost records on construction and on highway jobs?

Do you know the experiences of other contractors and engineers with piece-rate, bonus and other systems of wage payment.

The chapter headings are —I. Laws of Management. II Rules for Securing Minimum Costs. III. Piece-rate, Bonus and Other Systems of Payment. IV. Measuring the Output of Workmen. V. Cost Keeping. VI. Cost Keeping as Applied to Highway Construction. VII. Bookkeeping for Small Contractors. VIII. Office Appliances and Methods. IX. Miscellaneous Cost Report Blanks and Systems of Cost Keeping. X. Systems of Cost Keeping.

Slag Company Manufactures Concrete Brick

Birmingham Slag Company Has New Face Brick Plant at Ensley—Shope Process Used

The success of concrete brick made under the Shope process is well illustrated in the plant built over a year ago by the Birmingham Slag Co., at Ensley, Ala., where the company also has one of the most modern slag crushing plants in the world.

This company is probably the only one manufacturing concrete brick with slag as an aggregate; but under the Shope process the company is not only turning out common brick, but also face and mantel brick that can compare with clay and shale face brick of any and every quality.

The Birmingham Slag Co. owns the rights to manufacture this brick in Jefferson County, Alabama, and have built a $50,000 plant with a capacity of 30,000 brick per day. The brick plant adjoins the slag pit and slag crushing plant.

The slag used as the aggregate for the brick is No. 7 "Ensley Basic Slag," ¼ in. to dust in size. The slag is taken direct from the mill to the brick plant in regular open top, hopper bottom cars and unloaded directly at the measure box, which is right below the mixer.

It has concrete floors throughout and is equipped with 10 concrete tunnels, 10x5½x30 ft., which serve as the kilns or curing rooms. The building itself is of heavy frame construction. Brick was not used here because of the extremely good weather that prevails almost all of the time. The plant was designed from a standpoint of efficiency and in its construction the company spared no expense when it came to installing modern devices so as to facilitate increased efficiency.

Mixing Operation

As mentioned previously, the slag is dumped into a pit into which a measure box drops until the top of the box is flush with the floor of the pit. The measuring box is merely a skip hoist that carries the aggregate up over the mixer and automatically dumps into it. The skip is controlled by an electric cable hoist and the distance from the bottom of the floor to mix box is 18 ft.

As the slag is dumped into the 14 cu. ft. mixer, cement is added by the attendant, who operate mixer and distributes the finished mix to the brick machines. The mixer is situated on a platform 6 ft. above the brick machines. As the cement and slag are mixed, water is added through a perforated pipe over the mixer. The resulting spray tends to obviate considerable dust incurred during the mixing process.

As a batch is completed the attendant at the mixer dumps the material into a cart and delivers it to a mix box located between two brick machines. Along this platform are ten brick machines and five mix boxes. The mix boxes are built on concrete supports.

Brick Manufacture

The man at the tamping machine takes the mix from the bin at his side and fills the moulds. The bricks are made face-up and after thorough tamping the surplus material is struck off. The operating then adds the proper amount of water and color to the face of the brick, which he thoroughly agitates and works into the body by means of a wooden float made especially for this purpose. This operation gives the brick a base color and creates a density of from 1½ to ⅝ in. in the body of the brick, so that when the brick is laid up with a stripped or rodded joint it will be impervious to water. The finishing color is then applied and worked into the base color through a stippling process for a tapestry finished brick and with various other finishing tools, where other patterns are desired. The application of the finishing color completes the process of waterproofing.

The water used by the operator at the tamping machine is brought down through a flexible gooseneck hose, with a counter balance attachment to automatically lift it out of the machine when tamping. The hose has a special attachment at the end which enables the operator to spray the brick with an 8 in. needle spray. The water is turned on automatically when the operator pulls the hose down into position.

Attractive Fire Place built of Shope Brick.

After the brick have been "slicked" the operator lifts them from the machine by a rack and pinion arrangement, which leaves the pallet on the machine free. He places this pallet directly behind him, from where it is taken and conveyed to kilns or curing rooms. Only one off bearer, with a pneumatic tired truck, is needed to take the brick away from all the ten machines.

Curing Rooms

The ten curing rooms have counter-balanced drop doors and each room can handle 6,000 brick in 24 hours. The loading track is 26 ft. from the curing rooms and 4 ft. lower than the floor of the plant. A steel plate 4 ft. wide leads from the plant to the car. The company claims that this installation will make the loading of brick into box cars much cheaper.

The steam for curing is generated from an old reclaimed locomotive boiler. The steam is forced through perforated pipes running throughout the entire length of the curing room in an 8 in. trough of water. This gives the moisture necessary for the proper hardening of the brick.

The plant is constructed in such a way that only 20 men are required for the production of 30,000 brick. This number also includes the loading crew. The plant is also well situated to supply the demand for brick in Birmingham and at a recent "Own Your Home" exposition in Birmingham, the Birmingham Slag Co.'s exhibit proved to be one of the most interesting there. The company has made a success of their new venture. It markets its products under the trade name of "Slagtex."

Cutting Delivery and Labor Costs—Interchangeable Coal and Sand Silos

Efforts to cut labor costs are more important and pronounced today than ever before. This applies to the building supply and coal yard as well as on the farm or in the industrial plant. And the more successful one is in reducing labor costs, the bigger are his profits.

When the cost of handling sand, gravel, stone and coal by ordinary methods amounts to thirty or forty cents per ton and when modern methods and mechanical equipment do the unloading, elevating, distributing and discharging for three or four cents per ton, the saving becomes too important to be ignored.

Speed in handling is also an item. Unloading to storage bins at the rate of a ton per one or two minutes is common and when occasion demands it, much better time can be made. T. H. Mair, a building supply and coal dealer at Morrisonville, Wis., who has a set of four concrete coal silos or bins, unloads regularly twenty-five to thirty tons of coal per hour, when shipments are made in hoppers, drop bottom, battleship or box cars.

While one silo or bin divided into three or four divisions serves to handle as many different varieties or sizes of coal, Mr. Mair has erected a battery of four silos, two of which are shown in the accompanying illustration. The other two are directly behind those shown. These silos are divided into sections and use is also made of the space in the center formed by the circular walls of the four silos. In this manner, Mr. Mair is well equipped to elevate economically all of his anthracite and bituminous coal, as well as coke, providing nothing larger than the 6x3 egg size is attempted.

Gravity is used in the loading of wagons and trucks, which drive immediately under the chutes and receive their loads at about the same rate of speed as that required to unload and elevate the coal.

The Oakley Coal & Feed Co., Cincinnati, Ohio, has a battery of eight elevated bins. Three of these are used for the storing of sand and pebbles and five for the storage of coal.

Those used for handling materials are built with more reinforcing and thicker concrete walls than for the coal bins because sand and pebbles are about twice as heavy as coal. While the discharge openings or chutes for aggregates need not be as large as for coal, yet this company had them made the same size in order to make the bins interchangeable for coal, sand, or pebbles.

Profitable Coal Silos Both Saving and Making Money for the Building Material Firm of T. H. Mair, Morrisonville, Wis.

According to Mr. Guy A. Fribbe, president of the company, these eight bins save the firm eighty per cent over the old way of handling materials.

The Godfrey Conveyor Company, 139 Thirteenth St., Elkhart, Ind., are the originators, patentees, and manufacturers of conveyors operating gravity-filled bottom dump bucket over monorail. A request for their representative in your territory to call and submit recommendations and estimates will incur no obligation on your part whatever.

Useful Vest Pocket, Combination Concrete and Lumber Computing Scale

The Lehigh Portland Cement Co., Allentown, Pa., are sending gratis, to interested parties a copy of their latest feature for distribution to the trade, their combination concrete and lumber computing scale.

On one side, in various proportions, can be determined the quantity of cement, sand, and stone that is necessary for the mixture of one cubic yard of concrete. On this same side the quantity of cement and sand required in various proportions for the mixture of one cubic yard of mortar is shown. The reverse side shows the number of board feet in various sizes of lumber.

This scale is a revision of their former device, and they feel that in its new form it will be of interest to readers of CEMENT AND ENGINEERING NEWS.

Big Quarry Blast

One of the most interesting and successful quarry blasts set off in recent years was at the Southwestern Portland Cement Company's plant at El Paso, Texas.

In this operation 400,000 tons of rock were disintegrated and blasted down in fine condition for the steam shovel to begin its attack on the pile.

The blast was a multiple shot. For this purpose 47,000 pounds of powder was used, a battery of thirty-four 6-inch holes from 95 to 145 feet deep being bored with a No. 4 Clipper well drill. The lower 40 to 50 feet of the holes were filled with Atlas powder of 60 per cent strength. The upper part of the holes to 17 feet of the surface were filled with 40 per cent strength of the same powder. For the detonation a Cordeau plain fuse was used.

The illustrations of the rock pile after the blast shows only three-fourths of the pile.

Both powder men and quarry men pronounced this one of the most successful quarry blasts of recent years.

Large Trucks Show Lower Transport Costs

That the motor truck as an efficient and economical means of transport has received public recognition and support, can no longer be questioned. Those who are in close touch with the developments of highway transportation are predicting that the motor truck, even now, is but in its infancy and that big things are ahead in the way of public benefits to be derived from highway transport.

Chief among these benefits, according to R. E. Fulton, Vice President of the International Motor Company, manufacturers of Mack trucks, is the transport economy that will go with an extended use of large capacity vehicles.

"It can readily be seen", says Mr. Fulton, "as far as road wear is concerned, and when the amount of material shipped is considered in the bulk, that the use of large trucks causes no more destruction to the roads than the use of a far greater number of smaller vehicles carrying the same amount of material. It is only a question of time before those who have hastily judged the large truck as a destroyer of roads will be brought to the realization that there is an increasing definite tonnage that must be shipped by truck and cannot be diverted to other transport channels and that this material can be handled at a lower cost, with less congestion and with less road wear, by large trucks.

"It has been shown that the approximate costs of motor truck haulage per ton mile with trucks of various sizes average about as follows: 1½-ton truck, 16 cents; 2-ton truck, 13 cents; 6½-ton truck, 7½ cents. Obviously, this unit cost is less in the 7½-ton size. This economy in big units has a direct relation to the cost of commodities bought by the final consumer and so is an important factor in public welfare.

"If this saving in the cost of transportation was obtained only at the sacrifice of increased costs of road building and maintenance, it would, of course, be false economy. But this is not the case although it might seem to be at first glance. The reasons for this may best be seen by considering what would happen if all the large capacity trucks were taken off the roads. Since the amount of material to be shipped would remain the same, it would, of necessity, be transferred to a much larger number of smaller vehicles, and in many cases overloading would be encouraged. The smaller trucks would travel considerably faster and it is a proven fact that road damage increases with speed. The amount of dead vehicle weight in proportion to useful load carried would be greatly increased, thereby causing the roads to carry an excess amount of unnecessary weight. Congestion would be greater and the tendency to overload would have its natural effect upon public safety.

"Unquestionably, the future of highway transportation lies in the extended use and encouragement of large capacity units in the interests of both transportation economy and highway maintenance efficiency."

Conical Mill With Improved Trunnions

During 1921 The Hardinge Co., 120 Broadway, New York, designed a new mill with large trunnions which the company claims has been highly satisfatory in operation. It is the same in principle as the type formerly made by this company, but is the result of experience in grinding materials by both the wet and dry process. The bearings may be watercooled when grinding hot clinker; the Titanite lining lasts four or five years; the plate and screw type feeder has wide ranges of capacity. In fine grinding the mill is operated in conjunction with air separators and with electrically vibrated screens.

Increasing the Gravel Output in a Michigan Pit

When the United Fuel and Supply Company of Detroit undertook to increase the gravel output at its Oxford, Michigan, plant from 1,200 to 4,500 tons per day, it became necessary to go to a steamshovel basis and haul the bulk of material in dump cars to a field hopper discharging on a belt conveyor. Previous to that time two Sauerman draglines handled the entire excavation. They are still on the job, taking material from the bottom of a little lake, which has formed forty feet deep, but soon after the middle of May a Marion 61 steamshovel was installed for dry digging. The three machines together take out an immense amount of material.

The Sauerman draglines operate very efficiently from the lake bottom, the material being handled, as before, to stock-piles built over a tunnel, through which it is fed to a belt conveyor. The steamshovel loads into Western 6-yard dump cars, which, after a short haul, dump the material into a field hopper. From the hopper it is fed to another belt conveyor, by which it is taken to the screening and washing plants.

Dodge Mfg. Co. conveyors are used throughout in the various operations except where side dump cars are required in connection with the steamshovel. The Oxford plant illustrates in a notable way the efficiency of these two methods of conveying material, each supreme in its particular field.

In preparation for steamshovel operation it was necessary to lay considerable track, which involved 60,000 cubic yards of excavation. The 6-yard dump cars did good service there also, although purchased for handling gravel. This preliminary grading was started before the frost was out of the ground. Once having been dumped into the hopper from the steamshovel or on to the material tunnel by the dragline, until it emerges as washed sand, gravel, or crushed stone, of varying grades, the material is hustled along on great 36-inch conveying belts. The conveyor, carrying stone to the crusher is 600 feet long. Whatever the operation, the finished product is always delivered to the same loading track, which enables one gang to handle all loading.

The company recently installed electric power for the various operations, instead of steam. Altogether 1,095 electric horsepower are used. A high-tension current of 4,600 volts is stepped down to 220. An American Well Works electric pump delivers, 3,500 gallons of water per minute to the washing plant. Beneath this plant is a belt conveyor which carries the washed material out to the railroad cars, moving 375 feet a minute and loading a car in four minutes.

A peculiarity of the material handled is the preponderance of stone. There is no sand surplus. Twenty per cent of the stone is over-size and will not pass through a two-inch screen. Not counting this over-sized material, it runs 60 per cent stone, from 1½ inch in diameter down. The finished proluct comes out of the washing plant as ½-inch to 1½-inch gravel, $\frac{3}{16}$-inch to ⅝-inch gravel, torpedo sand, mason sand, or any desired mixture of these.

Scene at Washing Plant of United Fuel & Supply Co., Oxford, Michigan, Recently Put on a Steamshovel Basis—In Foreground is the Hopper Into Which Western 6-Yard Cars Dump Material—Dodge Belt Conveyors Beyond.

The washing plant operates in such a way that the company is able to guarantee any mixture ordered. If a contractor wants 70-30 gravel, for example, that is the mixture which the conveying-belt will deliver into the cars for shipment. The mixing is done by experienced operators as the material comes out on the conveying-belt.

The Oxford plant is the largest of eight plants operated by the United Fuel and Supply Company. They are of varying size, some of them portable, and load from 25 to 40 cars a day each, with the exception of the Oxford plant, where from 100 to 110 cars a day are loaded when the cars are available. Twenty-one men operate the entire Oxford plant. At Utica, Michigan, where nothing but torpedo sand is loaded, six men load 40 cars a day. This surprising feat was made possible by a unique portable screen, the invention of G. A. Seivour, manager of the sand and gravel department for the Company. It is said that when Mr. Seivour installed his ingenious screen the output of the plant was increased almost 200 per cent. The Company conducts its own engineering department under Mr. Seivour's direction, and has its own machine shop, with Fred Beal in charge as master mechanic. Sand and gravel production is only one of several activities. The Company owns from 7,000 to 8,000 acres of gravel land. Much of this land is still in farms and is cultivated under the direction of a farm superintendent. Among other things on this extensive property is a lake resort, not surprising in a county like Oakland which contains 360 lakes. A balanced business during the year is secured by handling fuel in car-lots, in addition to sand and gravel.

The general offices of the Company are in Detroit. C. M. Ray is President and General Manager; G. F. Barr, Vice President and Treasurer; M. B. Williston, Assistant Treasurer and Credit Manager; T. W. Murray, Assistant Treasurer.

Sand Lime Brick Manufacture in England

Began 80 Years Ago as Mortar Brick—White Cream to Gray in Color—Houses Built 16 Years Ago Equal to Houses Built of Other Brick.

A special report has been brought out by the British Department of Scientific and Industrial Research on sand-lime brick. They began as "mortar brick" of 80 years ago in Great Britain. These bricks were merely a mixture of sand and lime left to harden in the air; the process required from 6 to 18 months. Rather less than 40 years ago Dr. Michaelis, of Berlin, took out his master patents for the true sand-lime (calcium-silicate) brick, and it is the Michaelis process, all patents having long ago expired, which is now exclusively used. Once the plant is installed for making sand-lime bricks, it provides by far the quickest method of getting bricks. When "at" lime and a sharp clean pit sand are used it is quite ordinary practice to mix the materials one day, carry on the manufacturing process during the night, and deliver the finished bricks for sale next morning.

Any clean siliceous sand, from quarry, pit, or river, may be used; many other refractory and waste materials or by-products, such as slag, clinker, shale, quarry waste, and shards, are suitable. The only other necessary material is lime; either hydraulic or "fat" lime may be used, but it is found to be economical to go to considerable expense to use a "fat" lime if it is available.

At present prices a capital of about £12,000 is needed for an output of 3,000,000 sand-lime bricks per annum. A capital of about £15,000 is needed for an outturn of 5,000,000 per annum. This is a unit plant working at full power.

It is not easy at present to say what is the cost of manufacture. Before the war sand-lime bricks cost 11 to 12 francs per 1000 in France, 15 to 17 marks in Germany, perhaps 15 shillings to 20 shillings in England. Their present price in England is from 75 shillings at the field to 100 shillings per 1000 f. o. b., their gross manufacturing cost being probably about 45 shillings to 50 shillings per 1000, but this depends on the rate charged to the process for the sand.

Appearance and Uses of Sand-Lime Bricks.

In appearance sand-lime bricks are white, cream, or gray in color, perfectly regular in shape and size, and of a texture varying from that of sandstone to that of the Staffordshire blue brick. Ordinary white bricks can be colored with harmless pigments to any reasonable tint.

They can be used as a general substitute for ordinary burnt-clay bricks and they have those additional advantages which their regular shape, light color, sharp angles, and composition give them. For instance, they are used as a fair substitute for white glazed bricks for the interior finish in school rooms and corridors, dark passages, and ill-lighted public rooms. They do not disintegrate in frost; they resist acid fumes, and are, therefore, suitable for chemical works and chimney stacks.

Although the manufacturer of sand-lime brick is not widespread in England, there are, nevertheless, excellent samples of English houses built from 12 to 16 years ago of such bricks which have stood, if anything, better than burnt-clay bricks in the same locality. Their use at Reading, in particular, has been extensive and most successful.

Industrial Service

Mr. Waller Crow, well known in the cement, lime, gravel, crushed stone and the non-metalic minerals field, has opened up offices at 327 S. La Salle St., Chicago, as Waller Crow, Inc., a corporation which places at the disposal of these industries the services of a trained consulting, designing and engineering corps.

Until recently Mr. Crow was with the Schaffer Engineering & Equipment Co., of Pittsburgh, and previous to that connection was engaged in consulting work for some of the largest mineral producing companies of the country. His experience has also included geological surveys in many parts of the United States.

And added to these qualifications is Mr. Crow's natural tendency to hold himself to practical and economic considerations; to keep away from fantastical dreams, however appealing they may be, and keep in mind the fact that the function of an industrial plant is to turn out a product and make money by so doing.

His service is broad enough to include advice on problems of financing, operation and business management, as well as the purely technical work of design, construction and equipment.

Concrete Floor Tile

Roldan-Cammarata Cement Tile Co., 616 Biddle street, St. Louis, Mo., make an excellen grade of beautiful concrete floor tile in a variety of finishes. The company has been issued a certificate of quality by the Concrete Products Association, tests having been made on the member's products at Lewis Institute, Chicago. This member will sell floor tile to other concrete products manufacturers for resale to owner or contractor. This affords an opportunity for concrete block, brick and building tile makers to supply, without extra plant expense, a product which can be used in some part of every building erected. The profit on handling this high grade floor tile should make the proposition attractive.

Where the demand exists to an extent as to justify the establishment of a concrete floor tile plant the company will furnish equipment, plans instructions for the manufacture of the tile. It is recommended, however, that the buying and reselling of floor tile can be done by many products manufacturers and thereby develop the demand for this type of product.

Growth of a Great Quarry Co.

John A. Kling, for a number of years president of the Kelley Island Lime & Transport Company of Cleveland, Ohio, has retired from active management. The company started with a capital of $10,000, and now has assets of $12,000,000, and is the largest dealer in lime products in the world.

Hydrated Lime in Belle Isle Bridge Approach

The city of Detroit is noted for the many high-class structures which it contains. Both municipal and private structures are designed and constructed with a thought to their artistic appearance as well as to their strength and stability. Such a policy involves not only a careful consideration of the color of the concrete, but also study of its density and water-tightness.

Jefferson Avenue Grade Separation.

Painting or coating the surface is never satisfactory, so the concrete itself must be of a naturally light color. This clear, clean white color may be obtained by adding a small amount of hydrated lime to the mix. It is permanent, never darkening or becoming streaky. No further attention, except perhaps a periodical washing to remove the soot and dirt of the city, is necessary.

Other Advantages Gained by Use of Hydrated Lime

In addition to obtaining a pleasant color in the concrete, the advantages of smoothness of surface and permanent water-tightness are gained. As the concrete containing hydrated lime works easily, the surfaces are free from stone pockets and other blemishes. It is easily placed and flows into the forms and around reinforcing in a smooth manner. This is a double advantage, for it gives smooth surfaces when the forms are removed, and also practically insures a completely filled form and well-covered reinforcing.

What the Architects Report

Esselstyn-Murphy, Engineers and Architects in Detroit, who did the work on this bridge write as follows:

"We wish to state that all concrete used in the construction of this approach contained 5% hydrated lime by weight the percentage being reckoned on the weight of the cement and was added and mixed in the usual way. This same amount of hydrated lime was also used in the concrete work on the Belle Isle Waiting Room, and well be used in all concrete going into the construction of the new Belle Isle Bridge. We specified hydrated lime to be used in concrete work where a pleasing appearance was desired and when a dense waterproof concrete mixture must be obtained.

Lime Putty Formerly Used for Waterproofing

"It may be of interest to you to know the writer used lime putty as a means of waterproofing concrete as early as 1904, and has since used it almost entirely as a waterproofing agent. It was also used previous to 1904 by the late E. L. Ransome who, as a pioneer of reinforced concrete construction, relied on it altogether as a waterproofing agent, and it was the privilege of the writer to be associated with him for several years, and during that time performed many experiments with lime to determine its value as a waterproofing agent."

Belle Isle Bus Station at Jefferson Avenue Approach

Test of Heat Conductivity of Walls

An interesting blueprint chart is issued by the Associated Metal Lath Manufacturers, showing in a graphic way the relative amounts of heat passed by various types of wall construction. The figures are

the results of tests made at Armour Institute of Technology, Chicago, by Professor J. C. Peebles.

The relative heat transmissios are expressed in terms of British thermal units of heat transmitted per square foot of surface for each degree difference of temperature in one hour. In simpler words, the figures may be directly compared as relative amount of heat transmitted by each type wall.

Back plastered metal lath and stucco:	
*Flax insulation between studs	.333
*Extra thick insulating paper and 3-ply quilt	.347
*Common building paper doubled-out in between studs	.423
*Loose and tight building paper on inside face of studs	.449
No extra insulation	.548
Metal lath and stucco over sheathing:	
Common building paper over sheathing	.454
Stucco over 8-inch brick:	
Inside lath and plaster furred out	.557
Stucco over 8-inch hollow tile:	
Vertical flues stopped at story height—interior plaster on tile	.689
Vertical flues stopped at story height—interior plaster and lath furred ¾ in	.559
Flues open from cellar to attic—interior plaster on tile	.719
Flues open from cellar to attic—interior plaster furred ¾ in	.584
Stucco over 6-inch hollow tile:	
Vertical flues stopped at story height—interior plaster on tile	.690
Flues open from cellar to attic—interior plaster on tile	.738
Brick veneer sheathing:	
Common building paper—flues stopped at story height	.561
Common building paper—flues open to top of two-story building	.586

*According to specifications of American Concrete Institute.

Nine Million Dollars Paid to Injured Workmen

Of unusual interest to employers of labor and workmen engaged in hazardous employments, is the annual report of the Illinois Industrial Commission, which has just been made public. The commission is composed of Ernest Withall, chairman, of Chicago; Robert Eadie, of Springfield, and C. H. Kunnemann, of Granite City; Albert V. Becker, of Chicago, secretary. The headquarters of the Industrial Commission are in the City Hall Square Building, Chicago. We quote the following from the report:

Usually reports of this nature are composed largely of statistical tables and figures; yet the compilation of statistics is a mere incident to the work, and from them alone it would be difficult to derive an accurate impression of the activities and important public service rendered by the Industrial Commission, both from a sociological and judicial point of view. For a true comprehension of the work of a commission of this nature, one must keep in mind that its functions are two-fold. It is a matter of common knowledge that prior to the passage of the compensation law, a great volume of the work of the courts had to do with suits for damages for injuries sustained by employees in the course of their employment. Charities both public and private found their time and funds largely occupied in caring for workmen and their families during the long period of waiting which the old-fashioned lawsuit entailed and the outcome of which was doubtful even under the most favorable circumstances.

The Compensation Act was enacted as remedial legislation, but overshadowing its legal aspect, it is based upon a humanitarian principle. To preserve that principle the administration of the Act must be humanitarian. At every point of contact which the Commission has established between the employer and employee, it has sought to foster a feeling of sympathy and conciliation, a spirit of kindliness which takes away from both parties that vindictive attitude which makes for endless litigation. In the pursuit of this object the Commission has had, as a whole, the hearty co-operation of employers, employees and insurers. The intention of the compensation law is that its provisions shall operate to a great extent automatically, and that in the event of injury, the employee shall receive the full benefits prescribed, speedily and ungrudgingly, and that the interests of the parties, truly understood, are not essentially antagonistic.

As time goes on this doctrine is becoming more and more understood in its practical application. The success of the Industrial Commission in familiarizing both employers and employees with their rights and causing them to take a proper attitude toward each other, cannot be better illustrated than by reciting the fact that during the year last past over 50,000 accidents were reported to the Commission, while less than 7,500 claims were filed for arbitration; in other words, approximately eighty-five per cent of the accidents have been adjusted without recourse to arbitration. The increase in the work of the Commission is made apparent by the fact that in the year 1915 there were 12,240 accidents reported, as against 50,585 during the year past. This increase is at first sight appalling, but to a very considerable extent we think it is to be accounted for by the fact that the law becoming better known and understood, is more generally observed, and that whereas in 1915 only a small fraction of accidents were reported, at the present time nearly all industrial accidents involving a disability of more than six working days are reported in the manner required by law.

In a very large proportion of the claims filed with the Commission the only dispute has been as to the nature and extent of physical disability and the amount of compensation due; and in fatal cases, the question of whether or not death was the result of the accidental injury. When such a dispute arises an application for adjustment of claim is filed and a hearing had in the vicinity of the accident, before one of the arbitrators in the service of the Commission. The arbitrator then enters an award in accordance with the evidence presented. About twenty per cent of these cases are filed for review to the Commission itself. The efforts of the Commission have been largely taken up with the adjustment of these disputes. In this work the assistance of the medical department of the Commission has been of incalculable value. A great number of cases, where the only dispute has been as to the nature and extent of disability, have been referred to the medical department for examination and advice, without cost to the parties. This has resulted in the certainty of an impartial examination and often saving to the litigants the expense of bringing in expert medical witnesses to testify.

The report further shows that during the year last past there were reported to the Commission 597 fatal accidents and 49,988 accidents involving a temporary total disability of more than six working days. Compensation awarded in fatal cases amounted to $1,775,-

030.00. In non-fatal cases the enormous sum of $7,535,679.00 was awarded; a grand total of $9,290,709.00. Of this amount $731,911.00 was paid for medical fees and funeral expenses. Of all the industries covered, the greatest amount of compensation paid out as a result of injuries was in the coal mining industry, in which a total of $3,032,253.00 was paid. Metal products, machinery and implements, food beverages and tobacco, erecting, and cartage and storing, follow in the order named.

The greatest number of injuries were to the upper extremities, followed by head injuries. Cuts, punctures and lacerations were most frequent, closely followed by fractures. There were 44 cases in which it was found that the injured employee was totally and permanently disabled from pursuing any work. There were 2,494 cases in which specific loss of some member was sustained, and 1,817 cases resulted in disfigurement to the face, head or hands.

The greatest number of accidents were caused by objects being handled, followed by objects falling, and vehicles, in the order named. There were 48,987 males injured and only 1,916 females. While there is little variation in the number of accidents shown in any particular season, the month of August leads with 4,676, of which 64 were fatal. This is probably to be accounted for by the fact that outside construction work is at its height in this season of the year.

Fundamentals of Waterproofing

By EDWARD. D. BOYER, Cement Expert
New York, City.

Probably upon no other subject concerning concrete, are there so many conflicting and diverse opinions as that of waterproofing. Ever since concrete began the development which has carried it today to the forefront of building materials, the waterproofing question has agitated the minds of architect, engineer and contractor. Today there is still no definite and final answer to that question.

The difficulty of testing and properly weighing the results of the use or non-use of waterproofing methods, possibly is the explanation for the continued diversity of opinion. If waterproofing compounds are tested in the laboratory and found unnecessary for waterproofing concrete, the advocates of their use contend that the results are obtained under laboratory conditions and hence are not indicative of conditions on the actual work.

On the other hand, if an actual piece of work is rendered waterproof by the use of a waterproofing agent, we are never *absolutely* certain that the concrete would not have been waterproof without its use, or by the use of richer concrete or more care in mixing and placing.

Where Waterproofing is Necessary.

Extended tests* by the U. S. Bureau of Standards has indicated very conclusively that mortar and concrete properly proportioned, mixed and placed is practically water-tight or impermeable to any head of water up to 40 feet. In their summary of the tests mentioned, they state the following:

"Portland cement mortar and concrete can be made practically water-tight or impermeable (as defined below) to any hydrostatic head up to 40 feet without the use of any of the so-called 'integral' waterproofing materials, but in order to obtain such impermeable mortar or concrete, considerable care should be exercised in selecting good materials as aggregate, and proportioning them in such a manner as to obtain a dense mixture. The consistency of the mixture should be wet enough so that it can be puddled, the particles flowing into position without tamping. The mixture should be well spaded against the forms when placed, so as to avoid the formation of pockets on the surface.

"The addition of so-called 'integral' waterproofing compounds will not compensate for lean mixtures, nor for poor materials, nor for poor workmanship in the fabrication of the concrete. Since in practice the inert integral compounds (acting simply as void filling material) are added in such small quantities, they have very little or no effect on the permeability of the concrete. If the same care be taken in making the concrete impermeable without the addition of waterproofing materials as is ordinarily taken when waterproofing materials are added, an impermeable concrete can be obtained."

However, it would not be safe to say definitely that in all cases waterproofing agents are not necessary. It will be noted that the Bureau of Standards mention as contingent on waterproof qualities, care in preparation, mixing and placing. On some work the difficulties encountered preclude perfect concrete and perfect workmanship. In inaccessible locations such as structures below ground, tunnels, subways and sub-aqueous work, the difficulty of properly placing the concrete may be so great that no certainty can be placed upon the securing of dense, impermeable concrete without joints or cracks. Under such conditions as this, waterproofing is certainly to be advised.

Types of Waterproofing Agents.

Waterproofing agents and methods may be divided into two general classes:

1. Coatings or membranes.
2. Integral Compound.

In order to determine which type should be used on any certain work, thought must be given as to what way there may be a liklihood of defects in the concrete. If there is a chance of points or planes of weakness between the work of successive days, or if there is a chance of subsequent cracking or if there is a possibility of voids, pockets or segregation of aggregates in the concrete, it is obvious that an integral compound will not overcome these defects; in other words, no matter how waterproof the concrete may be rendered by the use of integral waterproofings, it is obvious that a crack or point in the concrete would allow water to pass through. To overcome such defects, a coating or membrane is to be recommended.

Coatings and Membranes.

Space will not allow a complete description and mention of all the various coatings and compounds. Coatings may consist of paints, oils, or bitumens. Such coatings are generally used where conditions are not extremely severe, and are particularly useful as dampproofing agents, and where it is desired to cut down surface absorption. The chief disadvantage of coatings is that they are generally not sufficiently elastic to bridge over any cracks which may occur subsequent to the application of the coating. To overcome this lack of elasticity, it is usual to employ a membrane composed of alternate layers of felt and bitumens such as pitch and asphalt. In this membrane the felt furnishes the binder for contributing the necessary slight "give and take," while the bitumens contribute the waterproofing qualities. Properly done, the membrane

*Technologic Paper No. 3, Bureau of Standards, Washington, D. C.

system of waterproofing is the most reliable and one which can be depended upon to the greatest degree for sure results. It is used for important structures such as tunnels, subways and similar work. Probably the greatest difficulty in the use of coatings and membranes is the fact that in general the concrete must be absolutely dry before the coating can be applied.

Integral Compound.

Integral waterproofing compounds are of a number of different types, the most general of which are:

1. Inert void fillers.
2. Active void fillers.
3. Water-repellin gcompounds.

The function of an inert void filler is to fill in the voids of the concrete. Such inert fillers consist of very finely ground material, such as clay, sand, hydrated lime or diatomaceous earth. Of these, hydrated lime is one of the best known and most efficacious. In mortars, it has the added advantage of securing greater plasticity and increased spreading power under the trowel.

Active fillers are substances which, when mixed with the cement and concrete, react with certain elements to form chemical compounds which are formed or deposited in the pores of the concrete. Many of these are oils which saponify or form insoluble soap to fill the pores.

Water-repelling compounds are compounds which, when mixed with the concrete, repel or keep out water by action somewhat similar to that of any oil which does not mix with water.

Conclusion.

From the foregoing it is evident that a decision regarding the use of waterproofing is one which requires considerable thought and a careful consideration of all conditions involved. It is also evident that the solution for one class of work does not necessarily apply to another. Great care must be exercised in interpreting results of the use of any waterproofing agent, because, as stated above, it is never sure as to whether the same effect could not be obtained without the use of the waterproofing. On the other hand, though concrete can be made impermeable, too great dependence should not be placed on securing a perfectly dense and impermeable concrete, since practical considerations and construction difficulties may make this commercially impossible.

Makers of Concrete Products Organize New Association

For the purpose of standardizing the quality of concrete products made and used in Southern California, a meeting ws called of the concrete products manufacturers from all parts of Southern California. At this meeting. held recently in the headquarters of the Portland Cement Association, a new organization was formed under the name of the Concrete Products' Association of Southern California. This organization will automatically become a local branch of the national body, which has its headquarters in Chicago.

The meeting was attended by practically all of the manufacturers of concrete products in Southrn California, who expressed enthusiasm at the idea of establishing a standard specified quality for all concrete products manufactured in Southern California; thereby establishing concrete as a dependable, durable and permanent building material.

The election of the following officers marks a definite step forward in the activities of the association; pesident, M. G. Watkins, who is president of the Los Angeles Concrete Tile Company of Los Angeles, Alhambra and Monterey Park; vice-president, R. E. Johnston, general manager of the Concrete Building Tile Company of Glendale, manufacturers of concrete hollow building tile and concrete brick. R. H. Hubbard, concrete products representative of the Los Angeles branch of the Portland Cement Association, was elected secretary and treasurer of the association. Four alternate vice-presidents were elected to serve as chairman of committees representing the various branches of concrete products manufacture as follows: E. J. Pennypacker, W. L. Jencks. F. C. Stenzel, and F. X. Enderle.

"The purpose of this association," said Mr. Watkins, "is to establish a definite and standard quality in the manufacture of all concrete products and to give the consumer a finished product that will continue to live up to the slogan of 'Concrete for Permanence.' We have accepted as a standard the American Concrete Institute specifications, which are now the basis of building codes in most American cities. In addition the association intends to give immediate attention to building code and adjustment and all other things of direct interest to the local manufacturers and those who use concrete products."

Gravel Company Makes Concrete Brick

At the plant of the Willard Sand & Gravel Co., Farmingdale, L. I., New York there is an abundance of sand and fine gravel obtained by pumping operations on Long Island sound. It was found that the market for fines, which made up a large portion of the product, became weakened and a large part of the sand company's capital became tied up in piles of sand and small gravel at the plant.

A way was sought to use up these accumulations, a way which would provide a permanent outlet for the excess fine material that would continue to be produced at the gravel plant. Consideration was given to the possibility of using this material in the manufacture of concrete products, which culminated, after due investigation, in the organization of the Farmingdale Cement Brick Co.. of Farmingdale, L. I., N. Y. This company was incorporated about a year ago with a capital of $100,000.

F. C. Willard, who is manager and superintendent of the Willard Sand & Gravel Co., also is manager of the Farmingdale Cement Brick Co. John Pettigrew, of New York, is superintendent.

Plant of the Farmingdale Cement Brick Co. is equipped with machinery capable of producing 80,000 brick per day. At the plant is manufactured common and face cement brick and concrete products. The company has been operating nearly a year, the sand being used for manufacture being delivered from the Willard Sand & Gravel Co.'s plant located on the opposite side of switch.

Mr. Willard also states that specifications in New York City for air shafts require a white brick to be used and that brick from his plant are coming into common use for this purpose, many architects specifying the cement brick which have greater strength than the clay brick.

Preparing Sand and Gravel for the Ohio Contractor

The growing use of concrete and especially the enormous development in the direction of good roads makes the gravel industry a profitable business and one with a great future. Road contractors and gravel companies are very closely allied,—important factors in a great movement which in a few more years will give America a system of roads to be proud of. There are hundreds of these gravel companies widely scattered, wherever deposits of gravel can be found conveniently placed for shipping. Among them the Zanesville Washed Gravel Company, near Dresden, Ohio, well illustrates the methods used in taking out this material and preparing it for the contractor's use.

The property, consisting of forty acres of gravel, formerly was owned by E. A. Evans and T. P. Perkins of Zanesville. Mr. Evans, however, bought his partner's interests some months ago and is now sole owner, although Mr. Perkins remained for a time in charge as superintendent of the plant.

Twelve men and two boys operate this plant except when stripping is in progress, when a larger force is necessary. The stripping is done with an Osgood shovel, while another Osgood takes out the gravel, working against a 50-ffot bank.

Two Western six-yard dump cars are used for the short haul necessary. At the time the accompanying photograph was taken, for some reason only one car was in service. Hauled by a Vulcan locomotive, it was able to make the round trip between shovel and washing plant in about three minutes, so that there was little delay.

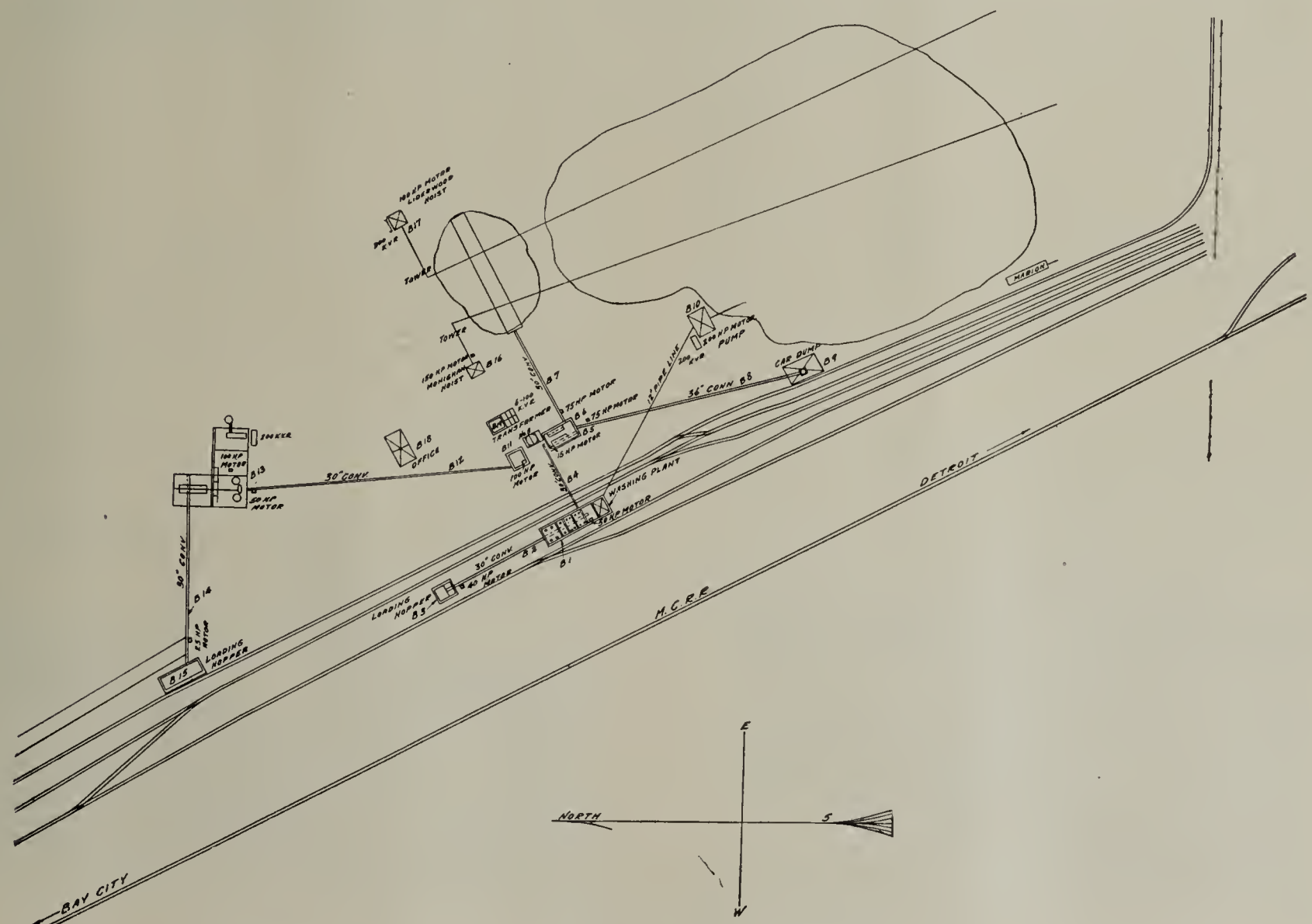
The usual practice, however, is to use two cars, loading one while the other is carrying its load to the washer. The washing equipment is reached by means of a 600-foot Gutta Percha & Rubber Mfg. Co., conveying belt—300 feet from center to center. Each car in turn dumps its load into a hopper, which feeds the material directly to the belt conveyor. The two boys then right the car and it is hurried back to the shovel for another load.

As the material leaves the belt at the top of the

Steam Shovel in Action. Loading Western 6-Yard Dump Cars.

plant a five-inch stream washes it into the screens. It is further washed while in the screens and water is turned on again during the loading process. In this way both sand and dirt are washed into a settling tank. The sand, being heavier, sinks to the bottom and the lighter soil floats out over the top. At times the sand is automatically dumped through the bottom.

This plant has a capacity of about 20 cars a day, the product being coarse gravel, pea gravel for road



Plant Layout at Oxford, Michigan. United Fuel & Supply Co.

Steam Shovel Loading Gravel Into Western 6-Yard Dump Car at Dresden, O .

surfacing, concrete sand, mason's sand and mortar sand. When railroad cars can be obtained the material is loaded into them direct. At other times it is stockpiled and rehandled with a loading crane.

How to Make Concrete Patches

Inquiry recently came to "Concrete" as to the use of lime water in cement mortar and concrete in making patches. Along this line Prof. Duff A. Abrams, Structural Materials Research Laboratory, Chicago, suggests;

"It seems quite apparent that the lime water would not do any harm, although I must confess that there is some doubt in my mind as to whether it does any real good in facilitating patching, or for any other reason. Our tests have shown that the addition of hydrated lime has a tendency to reduce the strength of concrete, although it would be expected that the small quantity of lime which would go into solution or remain in suspension in the mixing water would have a negligible effect on the strength of concrete.

"Our experience in patching concrete indicates that best results will be secured by the following procedure:

"1. Chipping off old concrete, exposing a new surface;

"2. Thoroughly clean surface;

"3. Saturate surface with water;

"4. Mix concrete or mortar same to stand for from 2 to 5 hours before it is put in place.

"With these precautions, any job of patching can be done with assurance of success. Allowing the concrete to stand for from 2 to 5 hours depends on weather conditions and seems to eliminate the initial shrinkage which is the cause of separation of new concrete from old in most cases."

Permanent Materials in Building

As a part of a nation-wide campaign designed to foster the use of more permanent materials in building, the Copper and Brass Research Association, 25 Broadway, New York, N. Y., has announced a contest for school cchildren and others, offering cash prizes for the best photographs showing the relative durability of materials which go into the construction of American homes.

Some idea of the cost to this country of the practice of building for speculative profit rather than for use is evidenced by the result of a statistical study just completed by the Copper and Brass Association. The fire loss on the 21,000,000 American homes, insured as they are for a total of $91,700,000,000, is about $35,000,000 a year, based on figures for 1918 to 1920, inclusive. The rust bill, covering the renewal of sheet metal work, principally leaders and gutters, plumbing pipe, hardware, etc., is annually twenty times that sum.

The effort to show the public the wastefulness of the use of materials which need early and frequent replacement, is a part of the present intensive campaign of the Copper and Brass companies of the country to increase the use of those metals in domestic consumption. The photographic contest is a part of that campaign.

Fourteen prizes ranging from $150 to $10 will be awarded for photographs of copper and brass objects of utility or ornamentation which to qualify must have been in use more than 35 years. Included are copper roofs, brass door knockers, old copper cooking utensils, brass plumbing pipe. Fourteen additional prizes of similar amounts are offered for the best photographs showing the results of using substitutes for copper and brass.

New Stripper Block

A new stripper machine is offered by the Anchor Concrete Machinery Co., Adrian, Mich. It is heavily built block equipment, and is turned out in three sizes, 16 in., 20 in., and 24 in., and makes any height of block up to 9 in. The 24 in. size will also make the Anchor high test building tile. The standard cores with this new stripper machine are made to match those in the Hobbs machine made by the same company. The feature of the blocks made on the new equipment is their large air space, the percentage running as high as fifty in the 12 in. wide blocks.

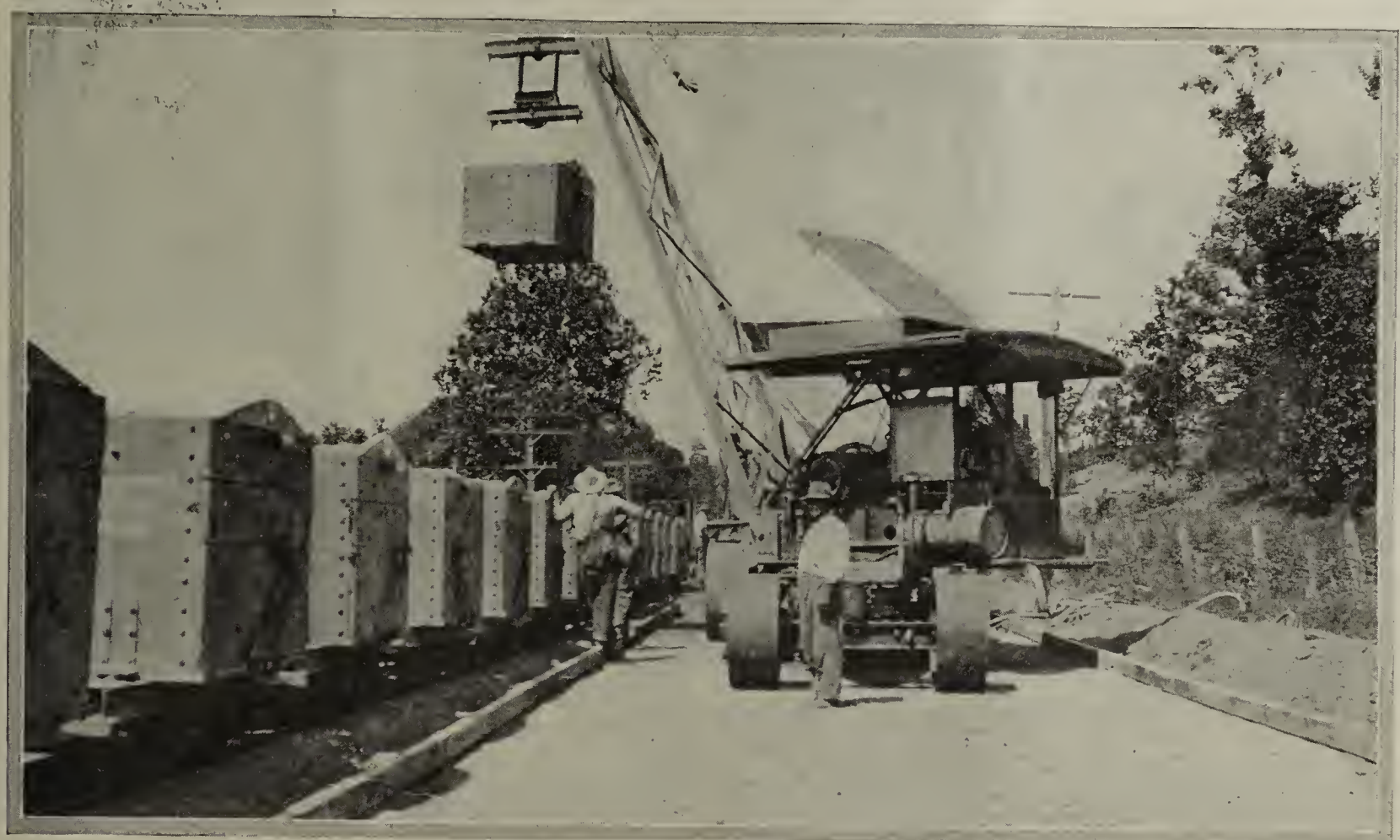
Concrete Road Construction in Illinois

James O. Heyworth, 607 S. Michigan Avenue, Chicago, is Constructing a Concrete Highway for the State of Illinois.

The state is furnishing all material—Ohio crushed limestone and Western Indiana washed gravel and sand.

The Heyworth contract calls for about 20 miles of concrete road, 1-2-3 mixer; 18 feet wide near important towns; 16 feet elsewhere; six inches deep at the outside; 7 inches at the center, with dirt shoulders six feet wide. In addition to this there are 30 bridges and culverts, two of them steel. One 113-foot span weighs 40 tonsffi another 100-foot span weighs 37 tons; a concrete girder bridge, 120 feet long, with one central pier, contains 50,000 pounds of reinforcing steel.

The bridge work is practically completed; so also is the heavy grading. There was a 30-foot cut through Auburn hill, requiring a 20-foot roadway at the bottom and involving the excavation of 15,000 cubic yards of material. This cut was made with Western wheeled scrapers and teams. Altogether the excavation amounts to 139,115 cubic yards of dirt and 157,697 cubic yards of stone.



Swinging Batch-Box to Mixer—These Boxes Hold 57 Cubic feet of Proportioned Material. Foreman Jess Kirby Stands in Front by the Machine.

For equipment Mr. Heyworth installed two Austin mixers, with a combined capacity of 1,6000 linear feet of 16-foot pavement per day; three Orton & Steinbrenner cranes for handling the mixers and batch-boxes; seven American 6-ton locomotives; 15 miles of 24-inch industrial railway; two finishing machines; two Austin 10-ton gasoline rollers; 350 Western Road Builders trucks; 350 Western batch-boxes—the large

Charging the Mixer Direct—The Bridge at the right was built by J. L. Heyworth

Modern Paving Methods—Hooking on to the Batch-Box

size—each with a capacity of 57 cubic feet. These boxes are carried one on a truck. Inside each box is a compartment for cement, holding two barrels.

The field office and unloading station are at Marshall, Ill., not far from the Big Four depot. Here large portable bins have been erected in three permanent sections, each of which can be transported on a flat car. The industrial railway passes under these bins, with switches outside to enable the locomotives to take on oil and gasoline without delaying the work. Cars of material when received are unloaded by crane, with clamshell bucket, into the bins or into stock piles, the unloading of a car taking ten minutes. A train of empty batch-boxes is backed under the bins for loading by gravity, ten boxes at a time.

Most of the cement is received in bulk and unloaded into the central bin. Occasionally, however, it comes in sacks, and to handle these a platform and chute have been rigged up at one end of the bins, as may be seen in one of the illustrations. W. R. Lake, who has had long experience in the business, is in charge of the loading station, where 20 men are employed altogether, only four, however, under the bins. On the entire job there are 125 men.

Improvised Loading Station—Loading Sacked Cement From Car to Batch-Boxes.

Under the Big Bin at Marshall, Illinois.

The maximum haul has been eight miles. In July it was about two miles. Trains, carrying 15 batch-boxes each, are run but owing to heavy grades it is necessary to run them tandem, giving on the grades a "double-header" train of 30 trucks. One locomotive can not hold its heavy train on the grades but by doubling the trains up and applying the brakes on the locomotives alternately this trouble is overcome. One train-load of 15 boxes of aggregates lays 50 linear feet of road and an average of 20 batches an hour are put through the mixer.

J. L. Heyworth's Material Bin at Marshall

It is a sight worth viewing to see one of the great mixing outfits in action. The mixer is not built with the usual skip near the ground, which is raised when loaded in order to discharge the batch onto the machine. The hoist on the crane reaches down and grabs one of the heavy batch-boxes, containing a batch of more than two cubic yards of material. High in the

air swings the box until it has been poised directly over the mixer at the top; then the bottom door is tripped by the operator, just as a clamshell is released, and the batch drops direct into the mixer—material enough to lay more than three feet of pavement 16 feet wide.

Strength Tests on Pre-Mixed Concrete on Detroit Street Railways

By W. R. Dunham, Jr., Chief Engineer, Engel & Hevenor, Detroit, Mich.

Concrete mixed overwet at central mixing plant was used for the base of the new track construction of the Detroit Municipal Railway Lines. Strength tests were made during the work and show remarkably consistent and high results.

The type of construction adopted depends for its permanency on the concrete foundation. In order that the work could be carried on with the requisite speed to insure its completion in the time assigned, it was necessary that the concrete be mixed with an excess of water, and this was also thought to be desirable in order that the mixture would flow around the steel ties, thus thoroughly embedding the ties and rail bases in a monolith of concrete. Some tests made on the concrete are given here to show the compressive strength of concrete mixed to the consistency of pea soup. Exact percentages of water content are not available. There are included tests made from samples cut out of the work as actually laid, and from samples taken each day from the mixers. These latter samples were taken in 6-in. cardboard cylinders and tested at the ages as given. At the age of 40 days, blocks were cut from the concrete monolith at the locations where the concrete from which the samples were taken had been deposited. These were dressed to size and tested. Twelve sample blocks were made in the yards using the same aggregate, sand and cement, and kept moist, six of these were tested at the age of 81 days and six at the age of 91 days.

The aggregate used was Detroit River gravel known as forty-sixty, or 40 per cent sand and 60 per cent gravel. To make up the gravel deficiency, 25 per cent of ¾-in. to 2½-in. crushed furnace slag was added.

The aggregate was delivered to the mixers by gravity from two compartment bins, the aggregate in one compartment and the slag in the other. These were delivered by chute into the loading hopper and the cement was added, the concrete being a 1:2:4 mix. Water was added until the desired consistency was obtained when the mixer was discharged into a train of hopper cars and the concrete was deposited. The average output per mixer per day was 400 cu.yd.

The consistency was such that the concrete flowed under and around the steel ties and up and over the rail base, but to insure the avoidance of voids under the plates of the ties and under the rail bases the concrete was tamped. The plates on the ties had 1-in. holes drilled in them to allow the impounded air to escape and prevent the formation of pockets.

Table I. Summary of Tests of Concrete Foundation.

Test No.	Compression Strength, Lbs. per Sq. In. 7-Day	28-Day
1	1,869	2,949
2	1,373	2,331
3	1,252	1,846
4	1,595	2,125
5	1,192	1,905
6	1,760	2,390
7	1,959	2,086
11	1,440	2,397
12	1,516	2,500
13	1,831	1,945
P-30	1,007	2,033
P-31	**675	**2,750
P-32	990	2,260
P-34	945	2,462
P-35	950	2,032
P-36	837	1,965
P-37	1,200	2,480
Average	1,317	2,262
Average first ten samples	1,579	2,247

**Least at seven days, next to highest at 28 days.

It will be noticed that the samples showing the least strength at seven days developed about the same strength at twenty-eight days as the other samples; and that the sample developing the least strength at seven days was the next to the highest at twenty-eight days.

Table II. Poured Specimens Compared With Those Cut from Structure.

		(Compression, Lbs. per Sq. In.) 7-Day	28-Day	40-Day	
Molded in Cylinders	P-30	*1,007	*2,033	M-3,411	Cut from track slab
	P-31	*675	*2,750	M-2,388	
	P-32	*990	*2,260	M-2,785	
	P-34	*945	*2,462		
	P-35	*954	*2,032		
	P-36	*837	*1,965		
	P-37	*1,200	*2,480		
Average		944	2,283	2,861	

*Poured. M Cut from slab.

Samples cut from the base as laid at the locations from which the cylinders were filled give strengths as noted in Table II compared with samples taken from mixer.

Table III. Test of Samples Made at Yard.

	81 Days	91 Days
	2,972	2,454
	2,609	2,644
	2,328	2,450
	2,229	1,923
	2,083	2,179
	1,322	1,968
Average	2,257	2,270

Tests of samples made at the yard using same proportion of aggregate and slag and same cement, and kept moist while curing are given in Table III.

What Our Motor Trucks Do and What They Cost

By J. Elmer McPhee
Sec'y McPhee & McGinnity Co., Denver, Colo.

We keep pretty close tab on our motor trucks and their cost of operation. In spite of all the written records that can be kept however, we find that the successful operation of a fleet of motor trucks is largely a matter of picking equipment of the right size and make.

On several occasions we have made thirty-day tests of trucks vs. horses, and have found that the cost of operation is practically the same. However, this is actually a decided advantage for the motor trucks as the horses handle all the nearby hauling, and the trucks deliver to the outlying districts. Figured on the cost per ton-mile good trucks would show a decided advantage.

We keep a comprehensive record of truck costs, even figuring down to cost per trip, but have not kept records of costs per ton-mile, owing to the difficulty and time consumed in obtaining and compiling data.

We operate a fleet of light delivery cars for "Zip" or rush orders, for city delivery, and one-ton and two-ton trucks for the large orders. We have found that for a city of this size a two-ton truck is the most economical and efficient as it can deliver cheaply and quickly to any size job by the use or roller dump bodies and roller wagons for loading.

Our records show that gasoline is the biggest item of expense, depreciation the second biggest, repairs the third, and tires the fourth. Other costs are so small that they do not enter largely into the problem. In buying trucks we consider first depreciation and then repair expense. We try to keep tire and gasoline expense at a minimum by securing the co-operation of the drivers.

The trailers in this city are not practical, owing to the fact that the two residence districts are at the top of large hills, and this causes unlue wear to trucks hauling trailers. It also increases the time consumed. The roll-off, or roller dump bodies, are more efficient than anything we have found so far for reducing the time consumed in loading and making deliveries.

It is our opinion that a dealer in every city has to adjust his equipment to local conditions, and that one standard will not fit every case.

Motor trucks have been a large factor in increasing our sales in the past five years, especially small orders which we feature with our "Zip" delivery.

It is our opinion that the motor truck has come to stay, but horses are still best for short hauling, and shipping or other delivery where long waits are necessary.

Here are some figures from our experience:

We find that our gasoline costs for the last six months on sixteen trucks amounted to $1,982.40, depreciation $1,841.16, repairs $1,898.50, and tires $1,227.03. By dividing these figures by sixteen you will arrive at the average cost of each car. These sixteen cars are made up as follows:

9 light Ford cars
1 1-ton Ford
2 Dodge ½ ton cars
1 White ¾ ton delivery
2 Kelly-Springfield 2-ton trucks
1 Pierce Arrow 2-ton truck

Depreciation we figure the same on all cars, namely, the cost of truck divided by an estimated life of 50,000 miles. Figured out to so much life for Fords, it is counteracted by the fact that repairs to Fords will eventually make a new truck, and our experience has proven that the oldest Fords so repaired have never worn out.

We have recently sold the oldest Ford we had for $250 or half its original cost so that you can see a depreciation of one cent a mile on Fords is ample. On the other hand the big trucks do not wear out so quickly but in keeping our equipment up to date we sometimes have to sacrifice them on a trade with a lot of useful life still in them. We find most firms in Denver who keep an accurate record of truck costs depreciated on the basis of five years. We believe that 50,000 miles is a little closer to actual experience.

For the six month period the Pierce truck cost 25.7 cents per mile; the 2 Kellys 25 cents and 13 cents per mile respectively; the Dodge 7.8 cents per mile; one-ton White 9.9 cents; one-ton Ford 7.4 cents; light Fords 7.6 cents. For a six month periods figures cannot be absolutely accurately due to the question of tires which may not enter into cost in a given six months. This accounts for the discrepancy in the two Kelly trucks shown above. The fair average would be one-half the total cost of the two trucks.

On city deliveries in the last six months of 1919 our figures show it costs us $2.36 per ton to deliver by two-ton trucks, $3.60 per ton by one-ton trucks and $5.77 per ton by one-half-ton trucks. For the first six months of 1919 it cost us $2.13, $3.38 and $4.70 respectively.

A Correction

On page 25 and 26 of our June issue we published an illustrated descriptive article entitled "Concrete Road Construction in Indiana" by the Cunningham

The "Plymouth" Gasoline Locomotive, manufactured by the Fate-Root-Heath Company, Plymouth, Ohio, hauling a train of cars in building a concrete road in Indiana.

Construction Company of Martinsville, O., and a mistake occurred in which the Plymouth locomotive shown in the picture therewith was named an "American."

Paper Molds for Test Cylinders

Concrete testing is made practical and easy by paper molds for test cylinders. How many strengths has your concrete? Are you getting 1,000 lbs. sq. in. when you pay for 2,000 lbs. sq. in.? Find out by using Standard paper molds for Standard 6"x12" cylinders. Twenty-five paper molds and a stapling machine are as light and as easy to carry as ONE old-fashioned steel mold. Easy to use, light, strong, waterproof, and inexpensive, they solve the problem of testing "on the job." Ask the Standard Concrete Apparatus Co., 1418 Rhode Island Ave., N. W., Washington, D. C., to send you a sample mold.

A Busy Concrete Block Factory

"Our plant is located in New York City on Staten island and therefore all our block must pass the inspection of the building department. Their requirements call for a strength of 750 lbs. per sq. in. of gross area at an age of 28 days. Department inspectors come to our plant while we are operating, select specimens for test and take them direct to the tesing laboratory. For each series of tests six block are selected and marked with a special city seal, writes D. J. Whitlock & Sons, Staten Island, N. Y.

"A fee of $10 per block is charged for making compression tests and $2 per block for absorption tests. A recent test of our block showed an average strength of 1030 lbs. per sq. in. of gross area for three block. No block went below 850 lbs. per sq. in. The absorption of our block average 7%.

"We have also had tests made on our sand by making 1:3 mortar cubes which were tested in compression at age of 28 days and found to develop a strength of 3510 lbs. per sq. in. as against 2686 lbs. for 1:3 Ottawa sand mortar cubes. Tests made on 1:3 mortar briquettes in which our sand was used developed a tensile strength of 438 lbs. per sq. in. against 376 lbs. per sq. in. for Ottawa sand mortar briquettes.

"We are operating two Hobbs block machines with Anchor power tampers and two Helm brick machines with power tampers, but have not made many brick to date, as we have no steam curing rooms for more than the block we now produce. We can hardly supply the demand for concrete block. Up to date all our block are sold before made while orders are booked well in advance.

"We have just bought two lift trucks which work fine, and as soon as we can remove present curing racks and substitute their portable racking system, our capacity for steam curing will be largely increased.

"This winter we will build a 2-story extension to our plant so that cement can be unloaded direct from motor trucks into the second story. (It will be noted that we are on a hillside.) Our clamshell will deposit sand in hopper at one end of the plant, so all mixing will be done on the second floor without interfering with workmen on first floor."

Sound-Proof Partitions

The demand for quiet rooms in hospitals, hotels, and office buildings, the desirability of insulating music studios and other rooms where disturbing sounds are produced, and the necessity for solving other problems for the control of noise have led to repeated requests from achitects and builders for reliable information on effective methods for insulating sound. Although present information on the subject is incomplete, Bulletin No. 127 of the Engineering Experiment Station of the University of Illinois, "Sound-Proof Partitions," by F. R. Watson, collects and presents the available information in a systematic way, giving the methods and results of various investigations relating to the action of materials on sound, describing practical installations of soundproofing, and setting forth in accordance with existing knowledge recommendations that may be applied where sound insulation is wanted.

While many things may be learned from further experience and much may be gained from additional theory, enough has been revealed to give encouragement to the belief that soundproofing may be prescribed in the future with some of the certainty that now attends the acoustic design of auditoriums.

Copies of this Bulletin No. 127 may be had without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

Lead Too Pure for Cathedral Roofing

There is such a thing as too pure lead for roofing purposes. The ancient Gothic cathedrals of Europe were topped with this grey metal that blended well with the stone work and the style of architecture.

Lead was the metal that was specified for the roof of the Episcopal Cathedral of Washington which is now being built but after it had been applied for some time, it was found that sheet lead on the steep roof slopes had a tendency to flow downward under its own weight and the heat of the sun. The nail holes enlarged and allowed the metal to slip partially off.

Metallurgists of the Bureau of Standards of the Department of Commerce were called upon and they found that the grade of commercial lead used was 99.9 per cent pure, far too pure for satisfactory roofing. They recommend the use of what is technically called "hard lead," which contains approximately six per cent antimony.

Lead roofs on European cathedrals have lasted for 300 to 500 years, and the metallurgists are of the opinion that lead as manufactured in those days had impurities sufficient to harden it for roofing use.

Tests of Concrete

Recent tests made with concrete by the engineers research division of the University of Texas, Austin, Texas, showed that there is only a slight variation in the strength of concrete.

Vey rich mixtures prepared with hard aggregates are slightly stronger than those prepared with soft aggregates. But for the leaner mixtures, the concretes prepared from soft aggregates are fully as strong as the concretes made from the harder rock.

Specimens three months old were used to determine how the strength of concrete varies with the strength of the aggregates used. Soft limestone, medium limestone, dolomite, porphyry and trap rock were used in the tests, and the strength was found to vary from 5,000 to 35,000 pounds per square inch.

The tests were in charge of F. E. Giesecke, professor of agricultural engineering of the university. According to Giesecke, until these tests were made, it was generally thought that strong concrete could only be made from harder aggregates. This rock is much more expensive than the softer aggregates, and it often has to be shipped great distances to the place of construction of a building, when the softer rock may be obtained in the locality.

Detailed reports of this series of experiments will be issued in bulletin form at an early date.

Keeping the Drills Out of the Shadows of the Shovels

One of the nightmares of a quarry superintendent's existence is to have the shovels "hot on the heels" of the blast hole drills. Especially is this true in quarries of rock of more than average hardness and with high working faces were steady hole making is at the best an uncertain quantity.

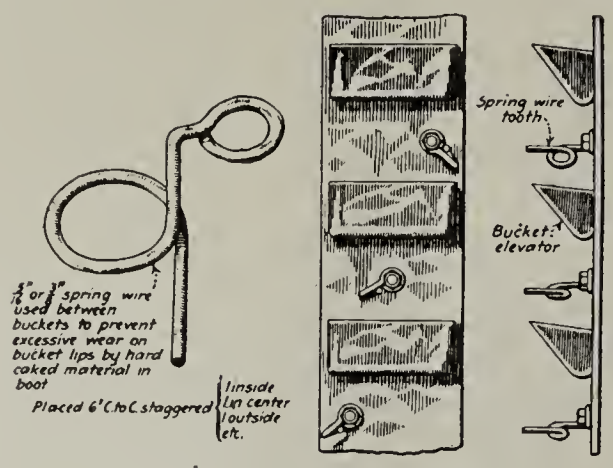
The cause of such an unfavorable condition of affairs is usually a breakddown on the drilling outfit. Preparedness precautions in the way of extra drilling tools and rope may have been taken, but when a piece of "pot metal" on the drilling machine goes "on the bum" without notice a shutdown is inevitable until telegrams and express bring the repair from a distant factory—and in the meantime the shovels keep crowding on.

"The reasons for the absence of such emergencies in quarries where Cyclone No. 14 Blast Hole drills are operated are briefly set forth as follows: First, the main operating parts of the drills are cast steel; second, Cyclone Drills, drill faster than any other blast hole drill of the well drill type. This last may seem to be a broad statement, but it has been proved, and, furthermore, we guarantee it. Further details will be found in our catalog B-45, to which anyone interested in quarrying is welcome.

"In western Illinois, geologists tell us that the Niagara limestone outcrops. This extremely hard formation has been the bane of oil well drillers for years. It is probably this limestone which the Columbia Quarry Co. of St. Louis are producing in their several Illinois quarries. Their first Cyclone Drill purchased in 1912 has merited the purchase of three additional drills," writes the Sanderson-Cyclone Drill Co., Orville, Ohio.

Bucket Elevator Improvements

In elevator boots where the wet or coarse material cakes as hard as rock, the lips of the buckets become so badly worn that they have to be replaced, the remaining part being perfectly good. To prevent some


Spring wire tooth
Bucket elevator
1/4" or 3/8" spring wire used between buckets to prevent excessive wear on bucket lips by hard caked material in boot
Placed 6' C to C staggered
1 inside
1 in center
1 outside
etc.

Bucket elevator spring tooth

of the wear, a spring tooth such as that shown in the accompnying illustration is made of 5/16- or 3/8-in. steel wire, and is fashioned with an eye and hole for an elevator bolt of the size used. The tooth is bent 3/8 to 1/2 in. out of the bucket line and is made not over 1/2 in. longer than the bucket lip. These teeth are fastened to the belt between buckets, one being placed about every 6 ft. and staggered, one in the center and one on each side. This device placed on a bucket elevator taking coarse material, minus 2 in., helped greatly in keeping the material loose.

Steam Driven Air Compressor

The Sullivan Machinery Company, 418 People's Gas Building Chicago, are bringing out a new type of steam driven air compressor of large capacities, 1,000 feet and up, known as Class WD steam driven angle compound direct flow type. The steam end of this compressor consists of a four-valve cylinder, with the element of initial condensation reduced to a very low factor by the arrangement of the inlet and discharge valves, which provide for the flow of the steam from inlet to exhaust in a direct path, and for high compression, Bulletin No. 77-D, just issued by the Sullivan Machinery Company, describes three types of

portable air compressors, one for gasoline engine drive, one for electric motor drive and one for belt drive from a tractor. Bulletin 70-X describes the Sullivan compressed air clay-digger or spader, an entirely new device that will have a wide field of usefulness wherever stiff clay is encountered in narrow working quarters, such as pipe trenches, tunnels or foundation work.

Keystone Lime Kilns; Tube Mill Linings

Staecy-Schmidt Manufacturing Co., York, Pa., manufacturers of Keystone lime kilns, plant and good will is now owned and operated by the Hardinge Co., Inc., 120 Broadway, New York. The company has recently installed equipment to handle tube and conical mill linings, known as W-B type. This lining is a combination of chilled charcoal iron plates and alloy steel wearing bars. The plates known as "Titanite" are so made that the wearing surface is extremely hard, due to the chill, although the back is soft, preventing breakage due to brittleness. The wearing bars act as lifters, at the same time taking the greatest shock. Taper head bolts hold the bars in place and they in turn hold in the chilled plates.

This type of lining has proved more economical than even the allmanganese or chrome steel linings of the ordinary design. In fact, the continuous-run operating records of the Hardinge mill are due mainly to the durability of this lining.

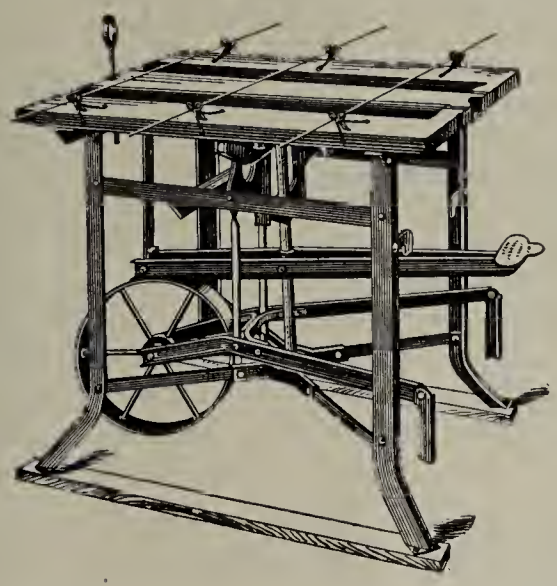
The development of the Keystone lime kiln has been carried to a point where entire lime burning plants are designed and erection supervised. It is automatic in operation and efficiency increased by refinements of apparatus used for charging.

Economy Sack Baler

Empty sacks, to a man without a machine for counting them and bundling them securely for return to dealer or mill, have proved to the cement user a bugbear. In any quantity, they represent a considerable item of expense, the units of which, it is true, are not big, but in the aggregate mean a direct loss that shaves off the gilt edge of profits for the user if they are not carefully and systematically disposed of.

The cement manufacturers and the railroads both lay down certain requirements as to the condition of returnable empties and the way they are to be done up for shipment. For meeting these conditions, a mechanical sack bundling and counting machine is a wise investment for the cement user.

The "Handy" Sack Baler, made by Handy Sack Baler Co., 620 S. Second st., Cedar Rapids, Iowa, is well named. It will pay for itself in increased credits allowed in a short time. It will enable you to count your sacks accurately and to bundle them perfectly. It makes it possible for you to count and bundle your sacks quickly and receive credit for them constantly, instead of permitting a large quantity to accumulate. Take, for instance, 20 bundles of 50 sacks each. This represents a dead investment of $100.00 for which



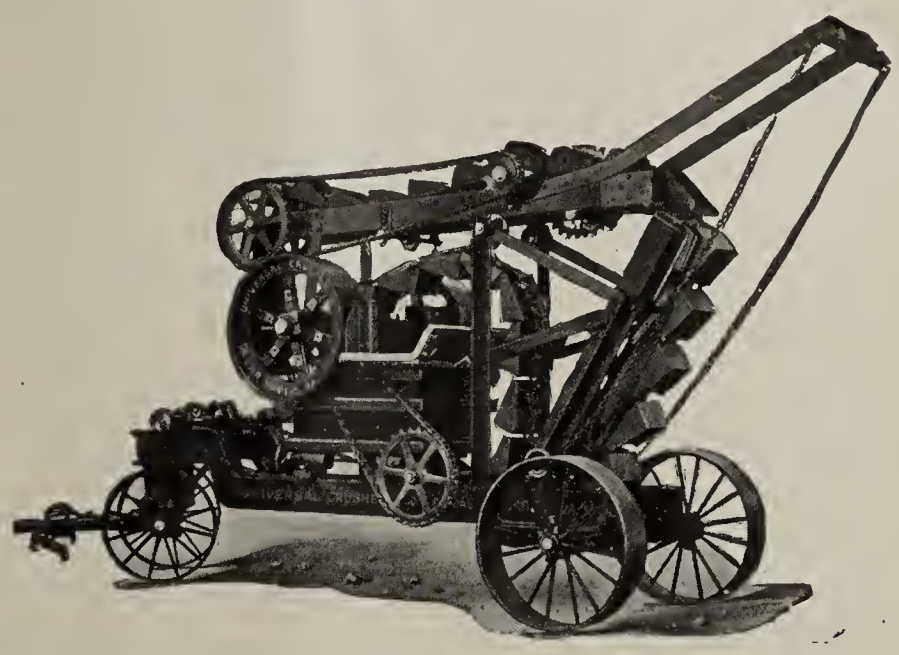
there is no necessity if you have an economical Handy Sack Baler.

The machine is simple in construction, and sturdily built. It will signal when 50 sacks are placed on the table; and a special feature of this baler is a locking device on the counter, so that a smaller number than 50 can be handled, and the dial always indicates the number of sacks on the table. Either wire or rope ties may be used, and the Company can supply wire ties cut to proper length, at lowest prices.

The cost of the Handy Sack Baler is so low as to put it within reach of even the smallest cement dealer, contractor or block or tile manufacturer.

Cast Steel Portable Rock Crusher

A new portable rock crushing plant for road builders has been produced by the Universal Crusher Co., Cedar Rapids, Iowa. The shell of the crusher is cast steel, making a stronger and considerably lighter ma-



chine than the former cast-iron equipment. With a 15x36-in. crusher opening the new plant weighs 14,250 pounds.

This outfit is made in all sizes for road work, the crusher openings ranging from 10x16 in. to 15x36 in. Another feature is the improved truck frame with double gooseneck made continuous with the I-beam sides and securely trussed. The I-beams are 8 to 12 in., according to the size of the plant.

Granite Face Texture Brick

The accompanying illustration shows a cement brick with granite face made on a Helm press and by the Helm process. According to this process granite, marble, feldspar or any kind of aggregate can be exposed in its natural beauty on the face of cement brick. The texture many be coarse, fine or rough; the face is readily waterproof so that moisture will show no more than on the finest clay press brick. The face is even stronger than

the body of the brick and the edges and corners are sharp and strong. Beautiful and distinctive textures can be given the commonplace surface of cement brick by this process.

The Helm Brick Machine Co., 764 Mitchell Street, Cadillac, Mich., gives the use of this process to purchasers of Helm cement brick machines. Cement brick is coming into wide demand all over the country and face prick like the above illustration will certainly find ready sale at very profitable prices anywhere. Interested inquiries can get valuable information by addressing the above concern.

News of the Cement Mills

The Ash Grove Lime & Portland Cement Co. is now paying a minimum of 35 cents an hour for common labor, while the pay to skilled workmen ranges as high as 80 cents an hour. The plant is operated on eight-hour basis. Labor represents one-third the cost of manufacture, fuel one-third and miscellaneous expenses the other third. The cost for labor is $40,000 to $50,000 a month.

The plant has a daily capacity of 3,000 barrels. It is capable of developing 5,000 horse power an hour and has in addition a miniature railway system of its own, with three locomotives, fifty cars and four steam shovels.

Its storehouse carries 5,000 different items and in wartime the value of the stock it contained was $350,000. The stock is so complete that the plant is frequently asked to supply repair parts to other cement plants and factories in this part of the state, and the cities of Chanute and Humboldt have also applied to it in emergencies.

It owns 1,500 acres of land upon which it is conducting farming operations. The production of the quarry averages over 1,200 tons a day.

The stock of cement which the company has accumulated in anticipation of having to suspend operations because of the power system change is the largest reserve supply the company has ever had—"the largest by three times," Mr. Sunderland commented.

Directors of the Riverside Portland Cement Company, Riverside, Calif., recently announced that an extra dividend of $1.50 a share had been declared, payable to stockholders of record on February 3. The company is thus the first big California concern to make an extra distribution this year.

Nineteen twenty-one was a very good year in the cement business throughout the country, and the Riverside Portland Cement Company fared particularly well on account of the tremendous building activity in southern California.

This is the third special cash dividend that the company has paid. From July 1, 1920, to May 1, 1921, dividends were paid at the rate of $1 a share a month on a capitalization of $2,500,000. A 100 per cent stock dividend was paid on May 15, 1921, since which date the company has been paying 50 cents a month on the increased capitalization.

Special dividend No. 1 of $3 a share was paid in July, 1920 and No. 2 of $1.50 a share on August 1, 1921.

Bath Portland Cement Co., Bath, Pa., is remodeling its coal plant by installing three mills for pulverizing coal. A conveying system is being installed in connection with these mills which will convey the pulverized coal from the mills to the kiln bins. The conveying lines will eventually be extended to the stone dryers, which will be fired with pulverized coal. The modern waste heat boiler plant, which has recently been put into service, will also use pulverized coal as an auxiliary fuel, the supply of pulverized coal being furnished from the coal house by means of a pump.

A several years' search for a rich deposit of calcium limestone lands mentioned in an Ohio State geological survey of 1874 came to a close last month when the George B. Ricaby Co. announced the purchase for the Sandusky Cement Co., of 500 acres of land at Silica, O., near Toledo on the Toledo, Angola & Western railroad.

The deal means for Toledo the largest and most modern cement plant in the country with a capacity of 1,000,000 barrels a year or more than 3,000 barrels per day. The plant will cost $1,250,000. Work on the plant will commence in the early Spring, S. B. Newberry, president and general manager of the company, announced recently.

Back in the early 70's J. S. Newberry, father of S. B. and W. B. Newberry, principal officers of the Sandusky Cement Co., was the state geologist. In his first report, issued in 1874, the elder Newberry called attention to a ridge of high calcium limestone showing various layers of corniferous formation and regarded as the most valuable deposit of its kind in this section of the country.

For several years the sons have been searching quietly for that ridge. The search has carried them to Antwerp on the Indiana state boundary line. A few months ago the ridge was definitely located at Silica.

The purchase of the property, announced in The Blade more than two months ago, began. The property is two and a half miles long by a quarter of a mile in width.

W. B. Newberry, assistant general manager of the company, who is here closing final details of the deal, said on Monday that no other deposit of this quality of limestone is to be found nearer than Alpena, Mich.

It was the high quality of the stone suggested in the report that has spurred the cement makers to the long years of search. In all the territory from Antwerp to Silica, drillings have been made, quarries have been examined and farmers have been questioned as to outcroppings.

The big cement plant at Petoskey, Mich., is regarded as the finest in the country. The plant to be built here will have all of the newest features of the Petoskey plant and all of the newer developments that have been perfected in the last few years.

R. J. Kellogg has succeeded E. M. Confer as superintendent of the Gulf States Portland Cement Co., Demopolis, Ala.

The Peerless Portland Cement Co., Union City, Mich., is installing two new mills in the coal house for preparing all the pulverized coal used as fuel in this plant.

The Continental Portland Cement Co., St. Louis, Mo., is installing a modern coal pulverizing and conveying system for fuel. This system includes three pulverized mills and conveying system for conveying the coal from the mills to the various furnace bins.

The Louisville Cement Co., Louisville, Ky., have increased their capital stock from $850,000 to $2,000,000.

A Guncotton-Nitroglycerin Dynamite Without a Headache

NITROGLYCERIN DYNAMITE has always been the standard high explosive. Until recently it has always had two defects, relatively unimportant in comparison with its basic advantages over other types of dynamite, but nevertheless marked disadvantages. First, it froze at a relatively high temperature, and second, it caused headaches.

Within the past year, the first of these disadvantages was removed through the production of a Du Pont Straight Dynamite which functions with normal efficiency at 10° below zero.

Both disadvantages have now been removed in Dumorite—a guncotton-nitroglycerin dynamite, which is not only absolutely non-freezing but is the first dynamite with nitroglycerin content which will not cause headaches.

Under ordinary conditions, Dumorite does approximately the same work as 40% dynamite stick for stick. And you can buy 135 to 140 sticks of Dumorite at the same price as 100 sticks of "40%."

Dumorite is saving money today for operators in most kinds of blasting work. If it is adapted to your work, your dynamite dollar will be worth $1.35.

Write our nearest branch office outlining your requirements and put the problem of reducing your blasting costs up to our Service Department.

Branch Offices:

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Huntington, W. Va.
Kansas City, Mo.
New York, N. Y.
Pittsburgh, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
Springfield, Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

NON-HEADACHE DU PONT NON-FREEZING

DUMORITE

News of the Concrete Products Factories

A semi-automatic feeding and finishing attachment for the Hobbs block machine is offered by the Anchor Concrete Machinery Co., Adrian, Mich., with the idea of speeding up production and increasing the uniformity of the block. The attachment may be put on any Hobbs machine without any changes in the machine itself.

The National Stone-Tile Co., manufacturers of concrete building tile equipment Merchants National Bank Bldg., San Francisco, Calif., writes:

"We are handling this proposition along entirely different lines from the usual concrete equipment. We are licensing exclusive dealers in each town and community to manufacture Stone-Tile and are furnishing them with the equipment for this purpose—also backing up their sales effort with considerable publicity and other sales help on our own part, in this way creating a strong demand for the product itself.

"The work of extension we are carrying out systematically, taking one section of the country at a time, securing our representatives there and putting forth the necessary effort to have Stone-Tile specified by the architects in that section. In other words, creating a thorough-going business for dealers, a section at a time.

"I am sure you will appreciate from this the reason why we prefer not to solicit inquiries from portions of the country which we are not yet prepared to handle and will bear with us on this."

In 1915 Mr. Harvey Whipple, managing editor of "Concrete," published a valuable treatise on "Concrete Stone Manufacture." At that time it was the first and only volume that had appeared on the subject and was read with eagerness by those who wished to inform themselves upon a subject that was destined to become a factor in the building industrial world.

Since 1915 this author has gathered much new data, made possible from practical experience and the development of the industry. The book, therefore, has just been completely revised and considerably enlarged and the new edition is just being put on the market.

The new volume covers more than 300 pages, with nearly 200 illustrations, and supplies as near a complete education on this kind of work as one can possibly get from a book. It includes chapters on the selection and combination of materials; the layout and equipment of plants; moulding and curing; surface treatment; shop records and cost keeping, and closes with some very pertinent suggestions on business methods and plans for selling the product.

The author has set out with a determination to give real value to his readers and has succeeded remarkably well. The book is bound in blue coth and sells at only $1.50. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, 22 Quincy St., Chicago, Ill.

We notice in your April issue, Vol. 34, on Page 27 an item on the use of Hydrate of lime in the manufacture of cement drain tile. It mentions information received from the office of the California Associated Concrete Pipe Manufacturers are using 5% of lime, but especially mentions this in the making of joints. Do you think this also refers to the use of 5% Hydrate of lime in the mix in the manufacture of drain tile. We would like to have you give us the address of the above association so that we may write them for this information, as the Drainage engineers are now specifying that concrete drain tile and pipe should not show to exceed 8% of absorption, and from articles that we have read on Hydrate of lime, and by its use would tend to make the tile dense and less absorption. If you have any information on this subject we would like to have you advise if in your opinion it would be suitable for the making of drain tile. Yours truly, Madelia Cement Tlie Co., Madelia, Minn.

James B. McQueen, Preston, Idaho, last season, he and his helper completed 9 monolithic concrete silos, 12 feet in diameter, varying in height from 41 feet, 6 inches to 42 feet 8 inches in just 90 working days, which includes the time spent in moving all equipment from job to job.

I have suspended operations in my plant until conditions are different. I cannot make blocks to compete with the cheap product others here manufacture. Until I can get an ordinance passed compelling all makers of blocks, etc., to make a standard product that will pass a test, and until an ordinance is passed requiring a test of concrete products, I do not intend to make any blocks.

I have shipped several jobs to Detroit, and my blocks passed the test, but the most of the rummies around here buy the cheap stuff, because they think they are saving a couple of cents, then put up a "holler" when they find out they are "stung." As it costs me as much to make my blocks as some of the others sell them for, you can see that I would not last if I could not make a profit. My blocks remain in the yard because these boneheads around here can't see why I should charge a couple of cents more for a block that you can hit with a hammer and have it ring like a bell, than the others charge for blocks made with a teaspoonful of cement to a yard of gravel, that you can crumble with your fingers. They look at the price and not the quality. This shows very plainly that the majority of the people buying blocks have nothing above the ears but hair and scalp disease.

I have been disgusted with the business for some time. It makes a man disgusted to have people come to your yard, show them an A-No. 1 product, give them a fair price, then have seven out of ten tell you that they can get blocks from others for two or three cents cheaper; go there and place their order, then hear them yell when their foundation is laid and their yard filled with a bunch of broken blocks laying around; but the fact remains that the other people got the order, and the money, and I still have blocks on hand. I have been tempted several times to make a blame cheap product and let the damn fools have the same cheap stuff the others make at the same price, as they seem to want to get stung; then I take another thought that it would ruin the future of the business, and I will make a good product or none. Signed, A. L. Raymond, Mt. Clemens, Mich.

ON that date a Goodrich salesman came out of one of the largest corporations in the world with an order for a Goodrich "LONGLIFE" Conveyor Belt. It was a very small order—obviously a trial order. Compared with the mammoth belts at work in this company's eight great plants its size was most insignificant. To gain entry for others of its kin, this "LONGLIFE" Belt would have to show qualities of durability, economy and smooth, flexible running, superior to any other belt at work on idlers.

Did it? Judge from these facts: Since March 4, 1911, this corporation has bought 42,422 feet of "LONGLIFE."

That is typical of the impression "LONGLIFE" makes wherever installed.

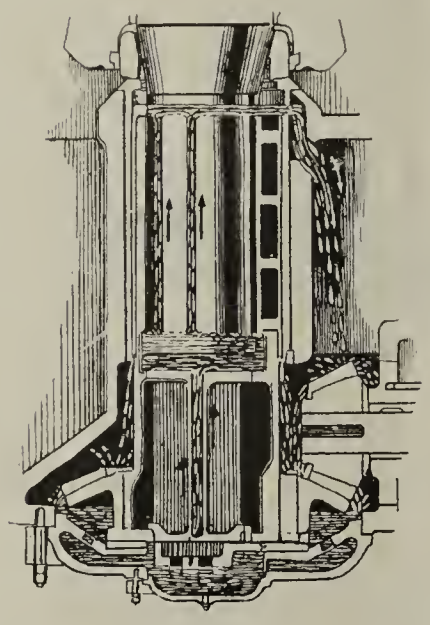
THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

Goodrich

"LONGLIFE" *Conveyor Belts*

No. 1600 MUSKOGEE OIL for ROCK CRUSHERS

Showing Automatic Lubrication of the eccentric and gears of Gyratory Rock Crusher—



GIVE your Rock Crusher real Lubrication by using No. 1600 MUSKOGEE OIL. Wire or write for Prices, Samples and Specifications. Tank Car or Barrel Shipments.

OKLAHOMA PRODUCING & REFINING CORPORATION
MUSKOGEE OIL
"It's Got the Body"
TULSA, OKLA.

WHY NOT BETTER BLOCKS AT LOWER COST?

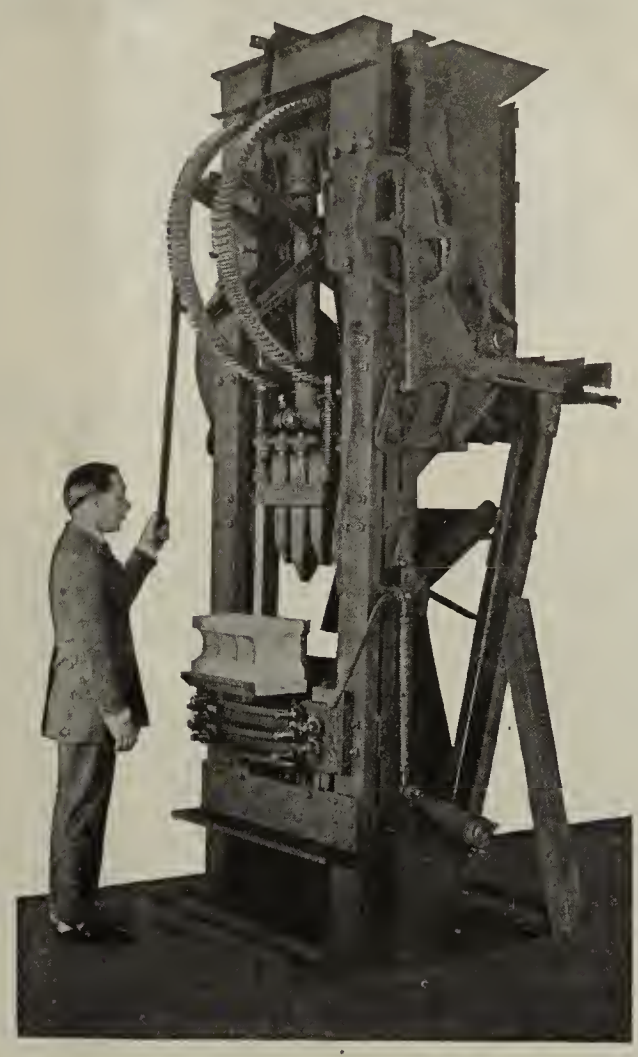
The Post Economy Punch

FOR BIG PRODUCTION

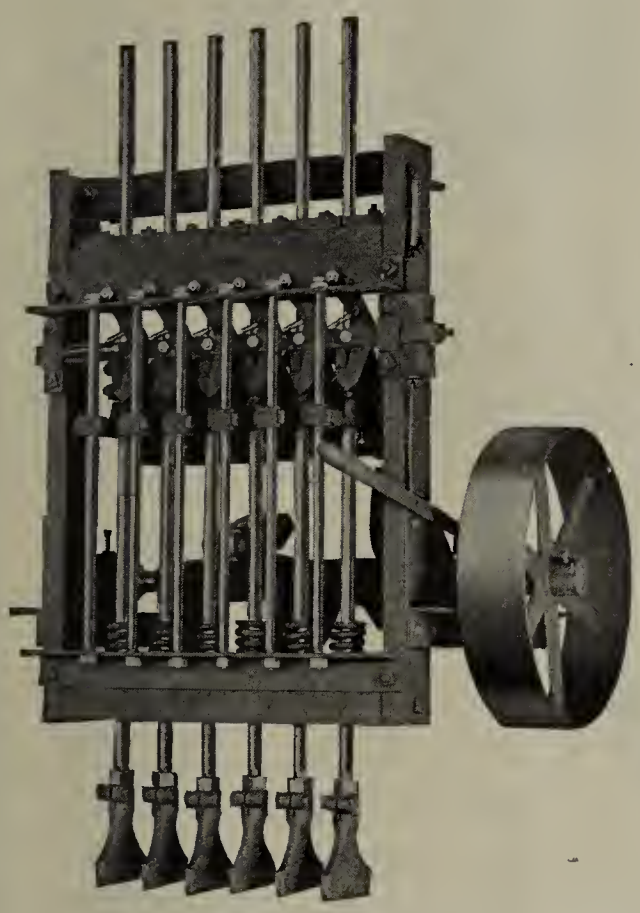
POST Economy Punch makes blocks faster, better and packs them harder than any machine on the market. Let us prove it?

EACH block is equally well made. The amount of material contained is automatically measured. The same pressure is always exerted in packing.

PUT one of these machines in your plant. We give a positive guarantee with it. We know it can make good. Will you give us a chance to show you?



Post Economy Punch



"BETTER BLOCKS AT LOWER COST"

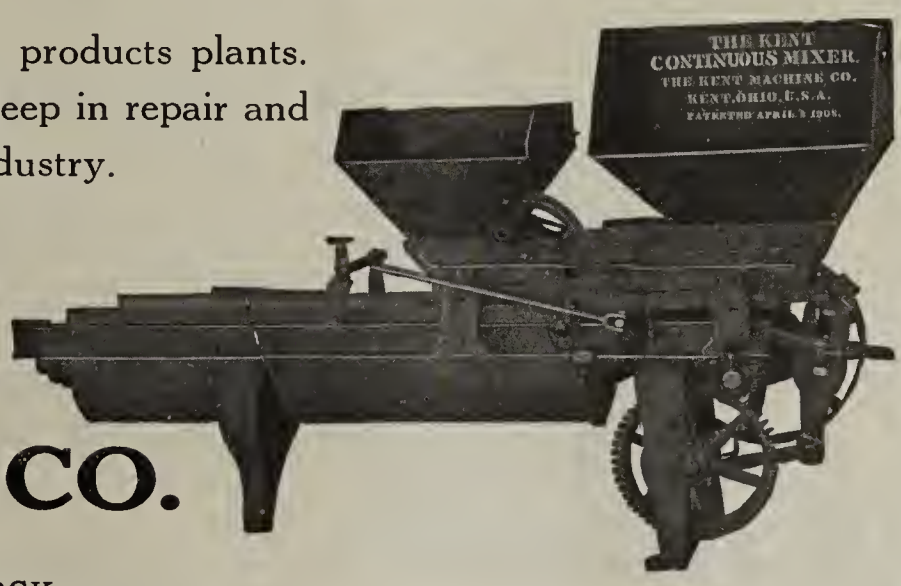
A Reliable Tamper for the Small Concrete Block Plant

The Kent Reliable Tamper has a shock absorber on each lifting foot, reducing noise and vibration of the lifting blow. It is substantial in design and is guaranteed against breakages due to workmanship and material. It will fit over any block machine.

The machine will not knock itself to pieces. The individual shock absorber looks after that. Long self adjusting bearings, rugged steel frame, heavy castings, stiff shafting, turned pulley, means a better machine and smaller repair bills.

THE KENT CONTINUOUS MIXER

Is especially designed for the needs of concrete products plants. It is low in cost, continuous in action, easy to keep in repair and it has a good clean record of 15 years in the industry.



RED LINE PRODUCTS

Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

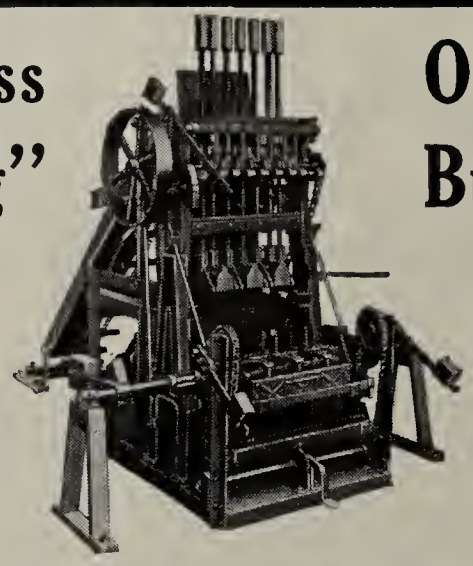
KENT, OHIO

CHICAGO OFFICE, 429 MONADNOCK BLOCK

"20 Years of Success and Still Going Strong"

The advantage of more than a score of years' manufacturing experience is yours when you purchase any product bearing the Ideal name. But that isn't all! In every device of ours is bound up the integrity, the conscientious service and the liberal guarantee of a company whose chief aim is to make **dependable machinery.** That's why it is safe to stick to IDEAL, "all that the name implies."

Ideal



Our Fully-Automatic Building Tile Machine

represents the latest and best thought of our engineers, embodying the most advanced principles of time- and labor-conservation. Delivers three tile on a single pallet, with no stopping or delay for off-bearing of tile.

The Ideal Concrete Machinery Co.
1338 MONMOUTH ST. CINCINNATI, O.

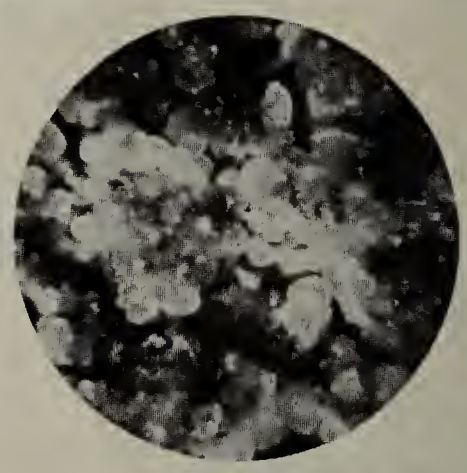
A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.



No Wonder Ordinary Concrete Takes Up Water

Here is a fracture from an enlarged laboratory sample of ordinary concrete containing twenty per cent or more of voids—an invitation to moisture to come right in.

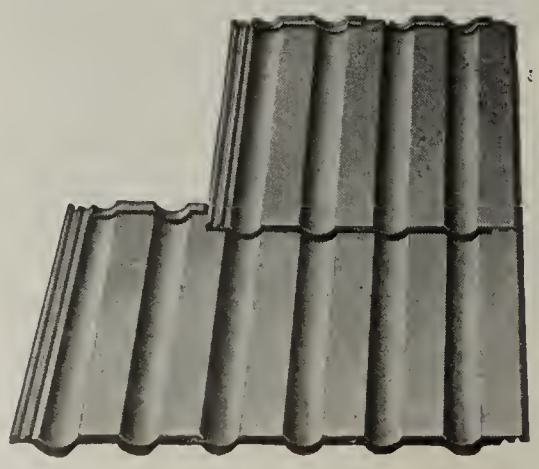
To keep dampness **out**—permanently and effectively use **Medusa Integral Waterproofing.** It protects mass concrete by coating all the voids with a permanent, moisture-repellent deposit that is as effective against oils and most chemicals as it is against water.

Specify Medusa Waterproofing wherever permanent resistance to dampness—either above ground or below—is to be an object.

THE SANDUSKY CEMENT COMPANY
Dept. E Cleveland, Ohio

MEDUSA WATERPROOFING
FOR CONCRETE

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

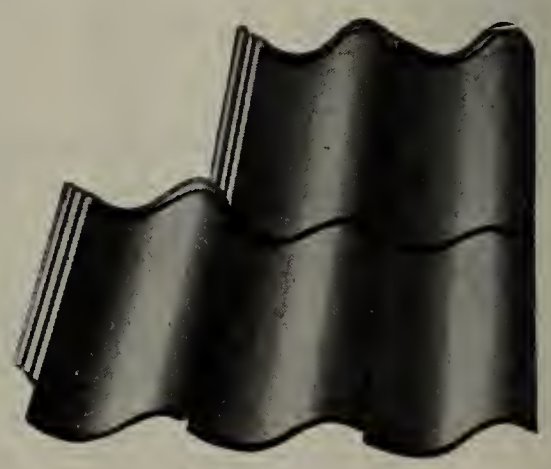
An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name: "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

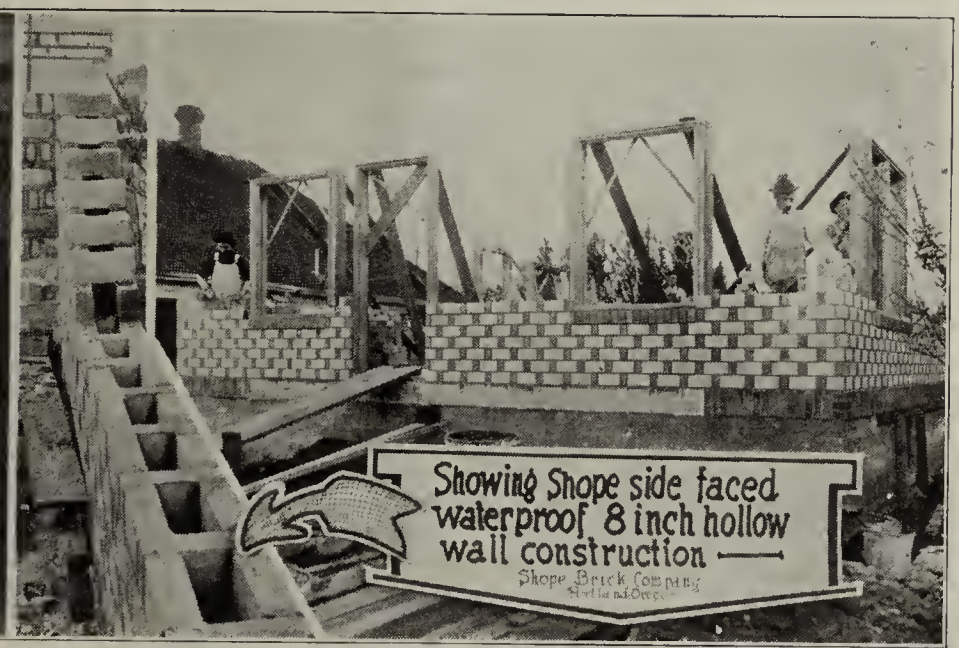
Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.
3617 E. 23rd Street Kansas City, Mo.



SPANISH TILE

SHOPE
CONCRETE BRICKS
The Brick With a Personality



There are cement brick and there are SHOPE Concrete Brick. SHOPE Brick are different. There is no competition for manufacturers of SHOPE Brick.
Shope Brick sell on a quality basis. You don't have to cut prices to compete with any building material.

The matchless beauty, the wide variety of facings and colors and the sterling quality of Shope Concrete brick allows an unequalled selection for both interiors and exteriors. Soft, pleasing finishes, restful to the eye, or a brilliant color to relieve the somber of an appealing duller tint, combinations of all kinds are possible with Shope brick.
SHOPE Brick manufacturers have exclusive territories, protected by basic patents on machinery and process of manufacture.

Investigate the manufacturer of SHOPE Concrete brick. Learn just how our equipment works, what kind of a product it turns out, how fast it does its business and how little labor is needed in a SHOPE process plant. Find out how SHOPE engineers can assist in equipping your factory to manufacture a maximum output of products with the shortest possible pay roll.

Shope Brick Company

361 East Morrison Street **Portland, Oregon**

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Company's Concrete Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

Make More Money out of Concrete Work!

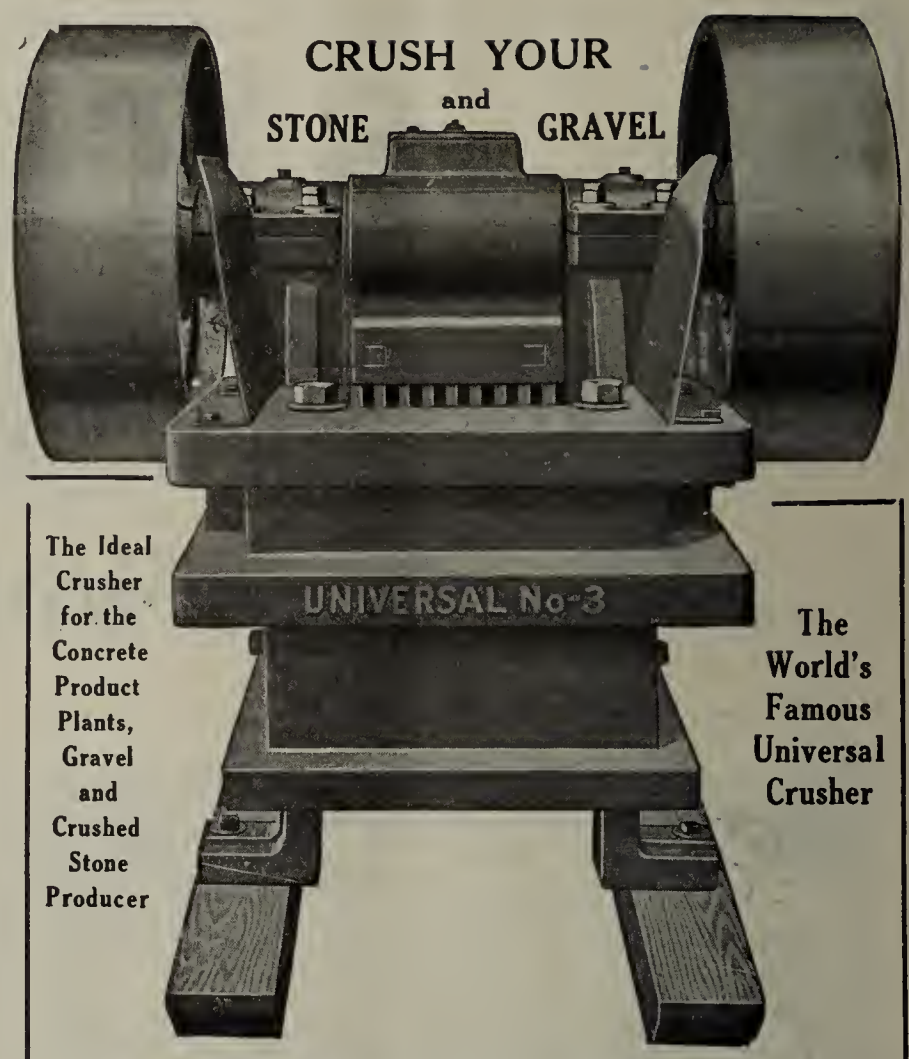
Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,

ONE MAN CAN RUN IT

The Little Whirlwind Concrete Mixer
THE MASTER MIXER
From Factory to You—Save 40%

Only ***real practical*** small mixer producing same ***perfect*** work as most expensive big machine. Complete with hand and power drive. A ***winner*** for the contractor or cement worker. ***All steel and iron.*** Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forms, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delays.

Patents Pending

Only $ 64.50

The Little Whirlwind Mixer Co.
451 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

SAVE CEMENT

Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

Write us for particulars.

Handy Sack Baler Co.
620 S. 2d St.,
Cedar Rapids, Iowa

FASTEST
ALLEY – STREET AND "ALL PURPOSE" MIXER BUILT

Get Our New Prices and Catalogs On Building and Paving Mixers (ALL SIZES) and Hoists

Write or Wire

The American Cement Machine Co. Inc.

Branch Offices In All Principal Cities

Keokuk Iowa
THE 300,000 H.P. ELECTRIC CITY

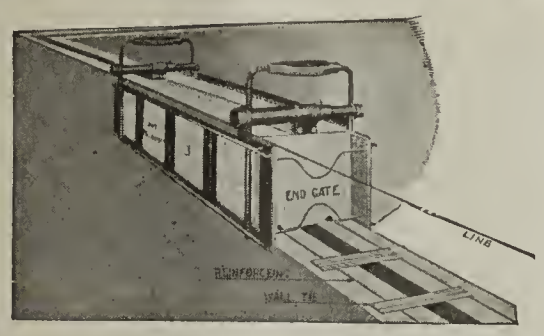
Prompt Deliveries From Stocks In Principal Cities

THE HOIST THAT HOLDS RECORDS FOR PILE DRIVING

MOST REASONABLY PRICED "ONE BAG" MIXER ON MARKET

Used By Over 6,000 CONTRACTORS

For 50% Build the Hollow Wall Way For 50%



Another most perfect Monolithic Hollow Wall Bungalow built with our molds at Long Beach, Cal.

Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company

224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

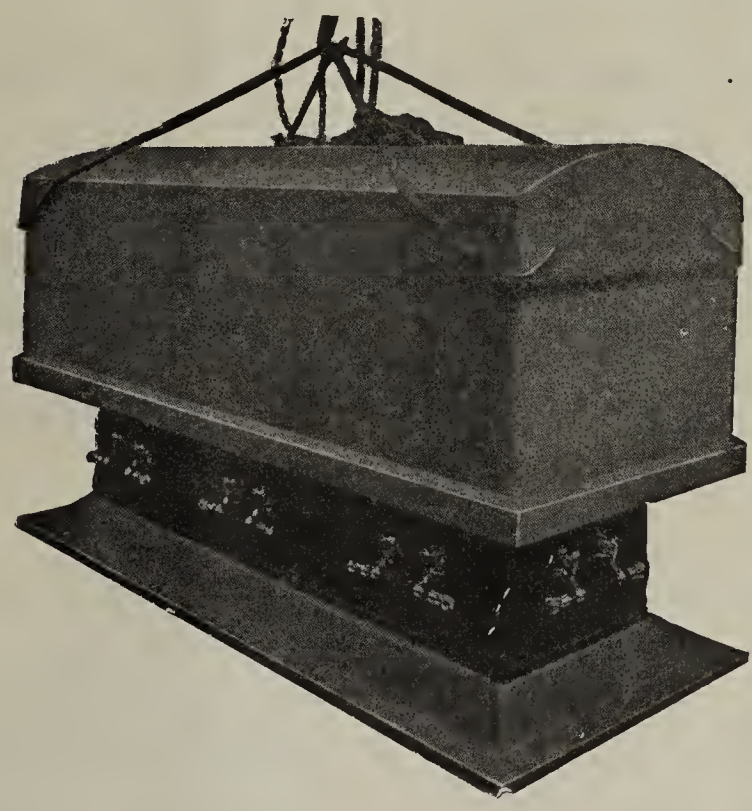
make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.



GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE" (Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples

VICTOR BALATA & TEXTILE BELTING CO.

Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston

CONVEYOR BELTS A SPECIALTY

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers—all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

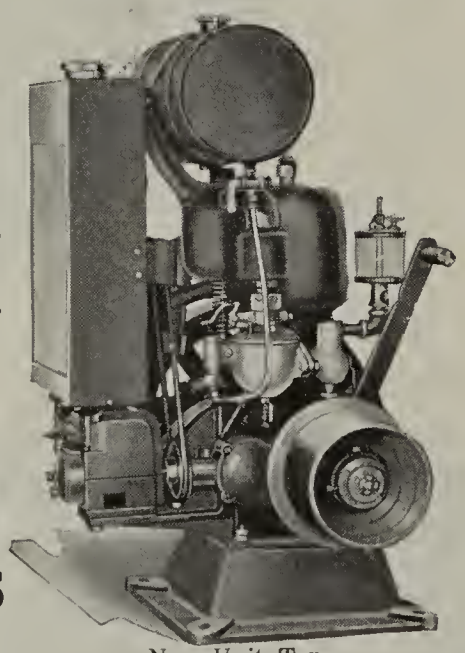
Sauerman Bros., 1139 Monadnock Bldg., Chicago

Your Machine Will Deliver Better Service With a

CUSHMAN

Light Weight Heavy Duty Engine

Over 50,000 in successful service. Sizes, 1½ to 20 H.P. Let our engineers work with you. Write us your power problem.



New Unit Type
4 H.P. CUSHMAN
Weight, complete, 230 lbs.

CUSHMAN MOTOR WORKS
821 N. 21st St.
Lincoln Neb.

HAVE YOU GIVEN PROPER CONSIDERATION TO OUR

POWER DRAG SCRAPER

The Economy both in installation cost and operating cost makes it well worth while to investigate.

The capacities range from 1/3 cu. yd. to 6 cu. yd., so you can readily adjust your expenditures according to your needs.

We would be pleased to give you information showing the various methods and where scraper can be seen in operation.

L. P. GREEN
907 Lumber Exchange Bldg. Chicago

Cement and Engineering News

Vol. 34 Chicago, AUGUST, 1922 No. 8

Cement—A Civilizing Force

What is this finer-than-flour building material called cement that you can mix with water, sand and stone—or other hard material—and cast into all sorts of shapes that become as hard and as enduring as solid rock?

Portland cement is an impalpable powder so fine that at least 78 per cent of it will pass through a sieve containing 40,000 meshes to the square inch.

It is composed principally of lime, silica, and alumina, obtained from (1) cement rock and limestone; (2) limestone or marl and shale or clay; (3) blast-furnace slag and limestone.

These raw materials must be properly proportioned, finely ground, and thoroughly mixed before burning.

The burning must be carried on at from 2,500 to 3,000 degrees Fahrenheit.

After the burning the resulting clinker is finely ground into a powder which is known as Portland cement.

The many different operations in the manufacture of cement must be carried on in a definite manner so the cement will comply with exacting specifications.

Several hundred different uses for Portland cement are known today.

Each is performing a distinct service in adding to the comfort, happiness and convenience of life.

This is truly the AGE OF CEMENT.

Although natural cement was utilized by the Egyptians in their Pyramids and by the Greeks in their aqueducts and temples, Portland cement was not developed for modern use until 1824.

It was named after a hard grey rock found on the Isle of Portland off the coast of England.

Since 1890 the growth of the industry has been most rapid.

In 1890, 335,000 barrels were produced. By 1900 this had increased to 8,482,020.

Today the production is around 100,000,000 barrels annually.

One hundred and fifteen plants operate today with a capacity of 140,000,000 barrels.

The capital invested in the industry is close to $300,000,000.

The mills in 1920 employed 36,500 men who were pair $61,500,000 in wages.

These cement mills not only maintain their own laboratories, chemists and experts, but through the Portland Cement Association co-operate for the conduct of research and experiments, placing the results of their studies at the disposal of the whole industry and the public.

The industry maintains 200 engineers in different parts of the country to help the public secure the best results in the use of cement.

The aim of the industry is to provide a product meeting the highest possible requirements; and to place at the service of the public its nation-wide facilities for furthering building and industrial activities.

Increasing Factory Efficiency

There are different schemes in use for increasing the efficiency of industrial organizations. It is a self-evident fact that modern machinery and up-to-date efficiency methods will do much toward increasing production and lowering cost. But because these improvements are open to all, there comes a point beyond which they may not go. It is here that the much discussed "human element" enters into the equation.

It has become almost an axiom in business that the contented workman is the best workman, and such schemes as profit sharing, industrial democracy, stock ownership, etc., have been installed with this end in view. These things are largely the outgrowth of big business. Previous to the days of big business, each workman knew the boss, and generally the boss knew how much each man was worth. Times have changed. Many thousands of workmen labor year after year without knowing who spends the products of their labor, and the problem of keeping these men working efficiently is a big one.

If it is the purpose of profit sharing to eliminate waste and to increase efficiency, then it is doubtful whether it succeeds, at least in any marked degree. It is too hard for the workman to see how any small savings he may make can have any effect on the amount returned to the employees. He is suspicious of profit sharing schemes, it looks to him as though they were designed to tie him to the job by holding up part of the money due him.

Industrial democracy is too new, too big, for one to prophesy what the future will bring. It means educating the workmen to it, and that will take time. At present, it is regarded as a device by which the employer can spy upon them and in consequence it is not looked upon very favorably.

Stock ownership is a good thing. It makes the worker a more integral part of the industry he is in, it has a marked effect on labor turnover; it increases the tendency to say, "our shop."

But in themselves none of these will solve the problem of increasing factory efficiency to its fullest measure. Some act of injustice on the part of the employer, some unwarranted call down to a popular employee, and none of these schemes will prevent a drop in plant efficiency.

The system that must be put into effect is a system that upholds the policy of fairness and courtesy. It never paid to bulldoze employees, it pays less than ever now. It is easy to keep a man working hard, the

simple device of threatening to fire him will usually accomplish this, but if the workman refuses to use his intelligence, then he is worth no more than the moron, and that is little. Efficiency is obtained by treating the satisfied, thinking employee as a man should be treated. In this way alone lies the pathway to success.

Use of Concrete Stone is Growing

The growing use of concrete stone in architectural designs bring before the architect new problems in the use of new materials.

It is a truism that the use of every material calls for a technique of its own, but it usually happens that the use of new material is handled at first in the traditions of material already in vogue. This tendency to imitate stone has been seen in all times. It is commonly thought that Greek builders imitated the trunks of trees in the Doric column and the flutings are supposed to be a conventionalized copy of the bark on the tree. Trylyphs and guttae are likewise supposed to be the ends of wooden beams with drops of condensed moisture hanging over them.

After the advent of stone cutting by machinery architects still use the tooled face on limestone blocks. This was the cheapest form of smooth face on a hand cut block, but its texture was so pleasing that architects continued to use it after the sawn surface produced by the machine was the cheapest.

Notable work has been done by some of the higher grade producers of concrete block and trimstone in the production of concrete surfaces and concrete structures which have an individuality that puts this material in a class by itself. And because of its economy, architects are turning more and more to the use of concrete for all kinds of architectural ornament.

This remarkable material has so many desirable characteristics that its use is sure to grow. It has the appearance of limestone, the placicity of terra cotta; there are no restrictions to the size of the blocks that can be made; it has an amazing variety of textures and with suitable reinforcement can support the heaviest loads in columns and lintels without difficulty. In work in which there is much repetition, such as a set of tracery windows to a church or in columns and finials, it is very suitable because of its freedom from inaccuracies.

Concrete Pipe

At the recent anunal convention of the American Concrete Pipe Association the secretary made the following statement, viz.:

"This Pipe Association should send men into the field to counteract competitive propaganda and see that the true facts are placed before the consumer. Under present conditions this would be impossible but the next best thing is to send out well prepared ability of concrete drain tile and each member of this Association should avail himself of this service the Association is willing and glad to render. Special attention is called to the bulletin published by Mr. Warren entitled "Concrete Drain Tile for Permanent Drainage." Other leaflets of this kind will be published from time to time.

"Producers of concrete culvert pipe undoubtedly have fewer obstacles to overcome than any other manufacturers, owing to the distinct advantages of this unit. Its great strength, to withstand the increasing load of highway and railroad traffic, and its permanence are great advantages. Many states specify concrete culvert pipe exclusively and others admit concrete pipe in competition with vitrified clay or corrugated metal encased in concrete. The great danger, however, confronting the concrete culvert pipe industry is the small producer with his limited capital, knowledge and slipshod methods. The only remedy for this is for recognized producers of concrete pipe to encourage county and state officials to test their product at the plant. This movement is now on foot in many of the leading states of the country and is being encouraged by the producers of concrete culvert pipe as the only way the good name of concrete culvert pipe can be upheld."

Cement Blocks Improved

"Cement blocks manufactured in Flint, Mich. have improved 100 per cent. since the ordinance regulating their production went into effect, and the blocks as offered by all manufacturers of cement blocks here are much better blocks." W. O. Kirkpatrick, city building inspector said recently.

To date, five manufacturers have taken out licenses as required by the ordinance governing. They are: Hanover Brothers, Flushing road; Mr. Frank of the Coldwater road; Mr. Clark, 937 Rosetta avenue; Eber Morin, 709 Baker street and Perry Francisco, 1301 Ann Arbor street. Each block has a brand of the owner.

Two or three more manufacturers are expected to take out their licenses after the first of next month. Their blocks have passed the tests required by the city.

"We now have facilities for testing gravel which is to be used in construction in concrete work. Anyone who wants to know the quality of gravel being used on the job in which he is interested should bring a sample in for the test," Mr. Kirkpatrick stated.

Concrete Railroad Ties Used

The Norfolk & Portsmouth Belt Line Railroad, which for the past three years, it is stated, has tested in service several specimens of a concrete railroad tie invented by W. T. Dickey, has it is reported, given an order for more of these ties to the American Concrete Tie Corporation, of Portsmouth, Va., which will manufacture them there. Among those interested in this new company besides Mr. Dickey is J. C. Darst, who is the first vice president. The company was organized recently.

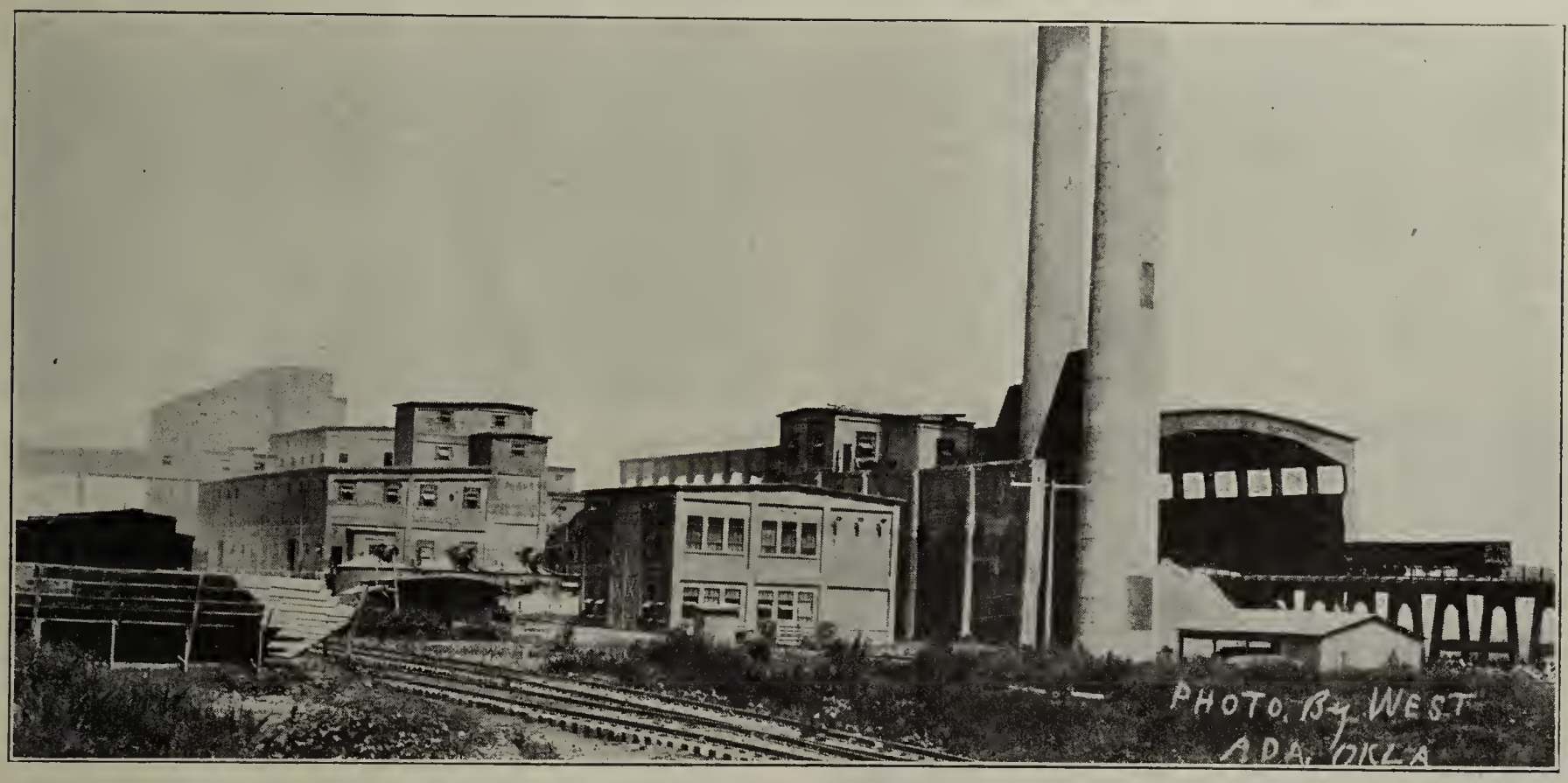
Stucco Plaster Fabric

A folder concerning National Stucco Plaster Fabric has been issued by the National Steel Fabric Co., 777 Union Arcade, Pittsburgh, Pa. This fabric is employed for making permanent exteriors, both new and overcoat, and is described as being not a lath, but a fabric and in a class by itself for this kind of work. Illustrations of buildings finished with it are given, also a table of stock styles.

Oklahoma Portland Cement Co. Increasing Capacity

The Oklahoma Portland Cement Company who operate two cement manufacturing plants at Ada, Oklahoma, have recently installed a new rotary kiln in their wet process plant and now have a new crew of men overhauling the old dry process plant. Work is also under way on the construction of a power plant, which will be in operation by January 1, 1923.

The company operates two cement mills at Ada, one a dry process plant with a capacity of 2,500 barrels per day; the other a wet process plant with a capacity at present of 3,000 barrels per day. The dry process plant has been operating for about fifteen years, while the wet process plant was completed in January, 1920,



General view of Oklahoma Portland Cement Co.'s plant at Ada, Okla.

and the description given below covers the operation of the later construction.

"O. K." which is the brand of cement manufactured at Ada is made of raw material consisting largely of limestone and shale. The deposits are located about six miles south of Ada at Lawrence, Okla., where the company operates a 2,000 ton per day crushing plant as well as a shale quarry with a production of 500 tons per day. The limestone and shale quarry are facing each other and are about three-fourths of a mile apart, and both offer practically an inexhaustible supply.

Sanderson Cyclone well drills are used for blast holing, cutting a 5⅝-in. hole. The company uses five drills, four of which are steam driven and one electric. Eventually, all of the drills will be electrically driven. The holes are drilled 14 feet back from the face and 14 feet apart, the average number of holes being 90. Two or three rows are shot at one time, the rows being staggered. The holes are charged with 50 per cent gelatine dynamite on the bottom and 40 per cent on top, the proportion being 1 to 4. All of the rows are shot at one time with a Cordeau-Bickford detonator.

The larger blasted stone goes through a second blasting to make it suitable for handling by steam shovel. This is done by means of Sullivan air drills and a light charge of ⅛ to ½-lb. 40-per cent dynamite.

The rock is loaded into 12-ton electric driven side dump cars (operated from a central tower) by means of a 60-ton steam shovel, with a 2½-cu. yd. dipper or with an 80-ton shovel with a 3½-cu. yd. dipper.

The stone is then transported in these cars a distance of one-half to three-quarters of a mile to the crusher where they are electrically dumped into a crusher. The preliminary crusher breaks the stone to sizes of 8 inches and down. The material is then discharged from the jaw crusher onto a feeder, the feeder discharging into a large slow moving chain and bucket elevator which elevates the stone to a height of about 80 feet where it is discharged into a scalping screen. All of the stone which is less than 2½ inches drops through the screen and by-passes the finish crushers. The finish crushing is done by two inches drops through the screen and by-passes the gyratory crushers and a No. 9 Jumbo Williams hammer mill which reduces it to 2½ inches and under. The discharge from these crushers are re-elevated and dumped into the sizing screens which separate it into the three sizes required, which is commercially sold as ballast, commercial concrete stone and in the manufacture of cement.

After the stone and shale reach the cement plant at Ada they are placed by the Frisco switcher on the elevated raw material unloading track which extends through the entire length of the stone and shale storage building. The switch engine makes two trips daily transporting from 12 to 15 cars each trip.

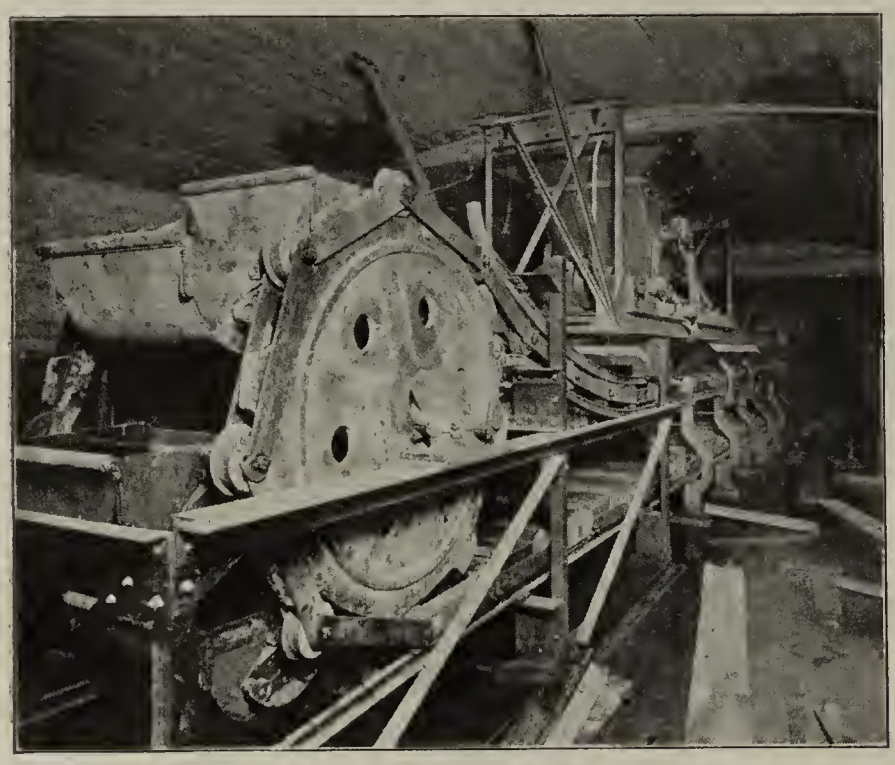
The stone and shale storage building is 300 feet long by 80 feet wide 70 feet high, built of reinforced concrete and consists of a 20-foot bay in the middle of the building used as proportioning department, with adjoining storage for stone and shale on each end. The approximate capacity of each storage is about 18,000 tons, sufficient for a two-months' supply for operation of the plant for shale and a one-month's operation for stone. The material is taken from the cars both by dumping and with a 15-ton direct current electric overhead traveling crane provided with a 4 cubic yard clam shell bucket.

To reclaim and distribute the material to its respective storage bins inside the raw storage building

this traveling crane and grab bucket also reclaims the material from these bins and feeds it to the stone or shale bin of the proportioning department. The stone bin is arranged so that it feeds the stone by gravity to a Schaffer poidometer.

From the poidometers the proportioned material is conveyed and fed into the top run of a 24-in. by 24-in. Perkins pivoted bucket carrier, and conveyed through a tunnel of 250 ft., elevated to a height of 45 ft. and deposited into the raw storage bins above the compeb mills.

The material is fed from the mill bins by gravity into the preliminary compartment of wet compeb mills. At this point enough water is added to give the mixture being ground approximately 40 per cent moisture. The preliminary compartment of this mill is equipped with a special set of grid bars so that when the material reaches the proper fineness it passes from the preliminary to the finish compartment of the mill. The preliminary chamber of these mills carries a charge of 20,000 pounds of 5-inch balls and under, and the finish compartment a charge of 62,000 pounds of ⅞-inch to 1¼-inch balls, both charges being variable and based upon the hardness of the material. The mills travel about 20 revolutions per minute and the power required averages approximately 525 kilowatts. Each mill has a capacity of approximately 70 barrels per hour. The fineness in the finish compartment is



Perkins Pivoted Bucket Conveyor handling raw materials from raw storage to bins above raw Compeb Mills

about 96 on the 100 mesh sieve, which has 10,000 holes to the square inch.

This material when it is discharged from the Allis-Chalmers compeb mills is called slurry, and flows by gravity into the special hatch tanks where analysis is made by the chemist. The batch tanks are three in number and hold approximately enough slurry to manufacture 300 barrels of cement. Adjacent to the batch tanks are located three control mix tanks, each of which has a capacity of 1,000 barrels, and it is in these tanks that the chemist is able to secure exactly the proper mix to manufacture a high grade cement. The top of the mix tank is just below the bottom of the batch tank, therefore the slurry flows by gravity to this point.

The mix basins are 34 ft. in diameter, 14 ft. deep, have a capacity of 1,000 bbls. each, and are of similar construction to the proportioning tanks.

The resulting mix is fed to an elevator pit, from which it is picked up, elevated and discharged into a trough that empties into two slurry storage basins 34 ft. in diameter, 22 ft. high, located underneath the feed end of kilns. These tanks are also provided with mechanical and air agitation, thus insuring a perfect mix. They have a capacity of 2,000 bbls. each.

The slurry from the storage basins is picked up by two elevators and deposited in the kiln feed trough.

Foote Speed Reducer connected to motor on Link Belt, type S Slurry feeder

On the addition of the third kiln, a third elevator will be supplied. At present there are two troughs, one for each kiln, provided with an overflow. From these troughs the slurr is picked by means of a scoop, or "S" type, feeder with a side center discharge and fed through an 8 in. pipe into the kiln. The scoop feeders are directly connected to 5. h.p. variable speed motors by Foote worm reduction gears. The speed of the motor is controlled by the burner in the kiln room. This is accomplished by means of signals and indicator dials. The amount of feed is controlled by increasing or decreasing the speed, according to the notches on the controller switch.

As soon as this material is O. K.'d by the chemist is is elevated a sufficient height so that it will flow by gravity into the two kiln feed tanks which have a capacity of 2,000 barrels each. From the kiln feed tanks it is elevated by bucket elevators and feed directly into kilns which are two cylindrical rotary kilns ten feet in diameter and 240 feet long. These kilns are lined with fire brick furnished by Davis Fire Brick Co., Oak Hill, Ohio, practically throughout their entire length.

Gas is used for fuel and the approximate heat attained in the burning zone is 2,700 degrees Farhenheit. The raw material at this temperature is calcined and forms into a clinker.

As these kilns rotate continually and as the intake end is considerably higher than the discharge end, as the material passes through the kiln it is discharged into a clinker pit from which it falls by gravity into a rotary cooler 8 feet in diameter by 70 feet in length. From this cooler it drops directly into the clinker pit from which it is elevated with a bucket elevator to the bridge between the mill building and clinker storage building and deposited into Perkins pivoted bucket carrier which in turn discharges it into the clinker storage bins, 25 feet in diameter and 85 feet high, each bin having a capacity of 10,000 barrels. A fineness of

82 per cent on a 200 mesh sieve, which has 40,000 holes to the square inch.

The entire new plant is electrically driven, and power is furnished to the company by the Oklahoma-Shawnee Power Co., Byng, Okla. It enters the company's substation at 33,000 volts through a set of four 1,000-k.w. 3-phase transformers. Two 100-k.w. motor generator sets furnish direct current for operating the overhead electric crane in the stone storage and for the excitation of the synchronous motors connected to the compeb mills.

A 10x2-cylinder low-pressure Sullivan air compressor furnishes the air for slurry agitation, while another single-cylinder air compressor furnishes the air for power purposes.

The power required for two units is in the neighborhood of 2,000 k.w. and it is estimated that 2,750 k.w. would be sufficient for operating three units.

Cost Data on Quarry Blasting

At the quarry of the Trumbower Co., Nazareth, Pa., the following detailed cost data were obtained at the time, a recent blast was shot in their quarry.

For this blast, low-freezing extra dynamite was used and the electric blasting caps were connected in parallel. The holes were drilled with Sanderson-Cyclone well drills. At 9 o'clock in the morning the loading began and 4:30 o'clock in the afternoon the blast was fired. Due to the dip of the rock stata, loading the holes was not an easy task, therefore considerable care was needed in order to get the explosive to the bottom of the holes. Here are cost data:

Fifiures Covering Blast at Trumbower Co. Quarry.

Hole	From face	Between Holes	Depth	Blasted, Cu. Yd.
1	12′	14′	50′	311
2	12′	14′	60′	373
3	12′	14′	65′	510
4	12′	14′	65′	510
5	12′	14′	70″	558
6	12′	14′	70″	558

Total (7050 tons) 2820

Cost of powder, low-freezing extra—

900 lb. 60 per cent at $19.25	$173.25	
1500 lb. 40 per cent at $16.75	251.25	
600 lb. 30 per cent at $15.75	94.50	
3000		$519.00
Drilling, 380 ft. at $1.25 per ft.		$475.00
Blasting supplies—		
Three No. 6, 40 ft. caps	$0.82	
Six No. 6, 80 ft. caps	3.03	
		3.85
Connecting wire		1.48
Total		$999.33

Estimated tonnage—7050.

Cost per ton (including drilling and blasting) $0.1417

Dixie Mogul Crusher

The Dixie Machinery Mfg. Co., 3665 Market street, St. Louis, Mo., announces that its new catalog giving full information on the Dixie Mogul crusher is now ready for distribution.

Drain Title Specifications Approved

The American Engineering Standards Committee has approved as Tentative American Standard the Specifications for Drain Tile (C4-21) of the American Society for Testing Materials.

The history of these specifications dates back to 111 when the A. S. T. M. organized its Committee C-6 on Drain Tile to meet two very urgent conditions. The comparatively recent use, on an extensive scale, of very large drain tile in public drainage works for reclaiming wet lands had brought about the unexpected discovery that these large drain tile were quite subject to cracking in the ditch under the weight of the ditch refilling. Also, the extensive production of concrete drain tile, and the resulting controversy between clay tile and concrete tile producers as to the merits of the new material made it urgent that additional data be secured. The specifications were based on a series of investigations covering methods of tests, the determination of desired quality and durability of drain tile, and a study of methods of manufacture and of construction and field specifications.

Nineteen standards have now been approved by the American Engineering Standards Committee of which four have been approved as "American Standard," fourteen as "Tentative American Standard" and one as "Recommended American Practice."

Concrete Fire Proof Dwelling

William M. Schmit, proprieor of the Saukville Concrete Products Co., has broken ground for his new home to be built at Saukville, Wis. Mr. Schmit is an ardent believer in fireproof construction and will build his new home entirely of concrete, including floors, etc. The entire building will be built of hollow tile with cement stucco applied on the outside. The new home is of the colonial type, will have ten rooms and will include the most modern improvements and conveniences. Mr. W. C. Large of Port Washington has been given the contract for the mason work, and John P. Dermatr of Saukville the carpenter ork. Although exact figures cannot be obtaied it is estimated by the contractors that $10,000 will be needed to complete the work.

An Engine Which Burns Many Oils

The Dodge Manufacturing Co., Mishawaka, Ind., in Bulletin 13, describe and illustrate the Dodge heavy oil engine in sizes from 10-12½ to 60-75 horsepower and for either marine or stationary service. The cover page shows a 40-50 horsepower engine of this make directly connected to a 30 KWDC 220 volt generator and supplying power for five plants. These engines, it is stated are capable of properly burning either crude oil, solar oil, fuel oil, kerosene, distillate and all of the differently named oil derived from crude petroleum. Tables give full information as to sizes, weights and capacities and the specifications are also completely described.

Operating a Pennsylvania Quarry on Three Levels

It takes a half-ton of limestone to produce a ton of pigiron. The quarrying of limestone, therefore, has become of importance in the Pittsburgh, Pa., district, second only to that of the steel industry. In fact, the presence of both limestone and coking coal, each necessary in smelting iron ore, has been the chief factor in the development of this famous steel district.

Among the largest of these quarries is that of the Carbon Limestone Company, at Hillsville, Pa., a few miles from Youngstown, Ohio, where a very fine grade of limestone is taken out for use in various blast furnaces of the district. This stone is handled in one-way, side-dump cars, heavily reinforced, which are manufactured by the company in its own shop, under the direction of Mr. Dunbar, car superintendent. The stone runs 90 per cent lime and there is no waste. Screenings, which are not suitable for blast furnace operation, are pulverized in a Gruendler Pulverizer and sold for agricultural purposes.

In such an extensive quarry operation as this, stripping is practically continuous. The stone lies from 18 to 40 feet under an overburden of clay and shale, with an intervening layer of coal in places, from which the company is able to mine its own fuel. The Carbon company is doing its own stripping at the present time, and altogether is operating eight Marion shovels in this quarry, stripping, taking out stone and coal.

A novel feature is the fact that these operations are conducted on three levels. On the floor of the quarry is a narrow gauge track which carries one-way side dump cars, loaded with stone. Crossing above this track is a standard gauge track, carrying trains of Western 12-yard dump cars, which are working with the large stripping shovels. In addition to this, stripping is also carried on with a narrow gauge equipment of Western 4-yard cars. These trains cross above the standard gauge track.

About 6,000 cubic yards of overburden are removed each day. F. O. Earnshaw is general superintendent of this important plant. His brother, W. G. Earnshaw, is quarry superintendent.

Loading Shale into Western 12-yard Dump Cars—Carbon Limestone Co.'s Quarry

W. G. Earnshaw, Quarry Superintendent

Sand Company Manufactures Concrete Products

Officials of the Atwood Davis Sand Co., Beloit, Wis., convinced of their ability to produce quality concrete and realizing the growing demand for concrete sewer pipe, culvert pipe and drain tile, recently organized the Illinois-Wisconsin Concrete Pipe & Tile Co., for the manufacture of these products. A plant, modern in every respect and equipped with pipe and drain tile machines and all accessories for quantity production of quality concrete pipe and drain tile has been built on the floor of the pit about 1,000 ft. north of the screening and washing plant. This concrete products plant is in successful operation and is using an increasing percentage of the finer grades of material produced by the sand company. The idea of utilizing excess material in the manufacture of concrete products is rapidly growing in favor among producers of mineral aggregates.

Safety Tile

Alundum Safety Tile made by the Norton Company, Worcester, Massachusetts, is the subject comprehensively treated in a large, finely illustrated catalog issued by them. This tile is used for floors, stair treads, ramps, elevator landings, entrances to public buildings, and in other places wherever a slip-proof, non-wearing surface is desired. The book contains data for architects and engineers, specifications for installations, conditions of construction and much other valuable information. The diagrams of applications are numerous and there are also representations of patterns.

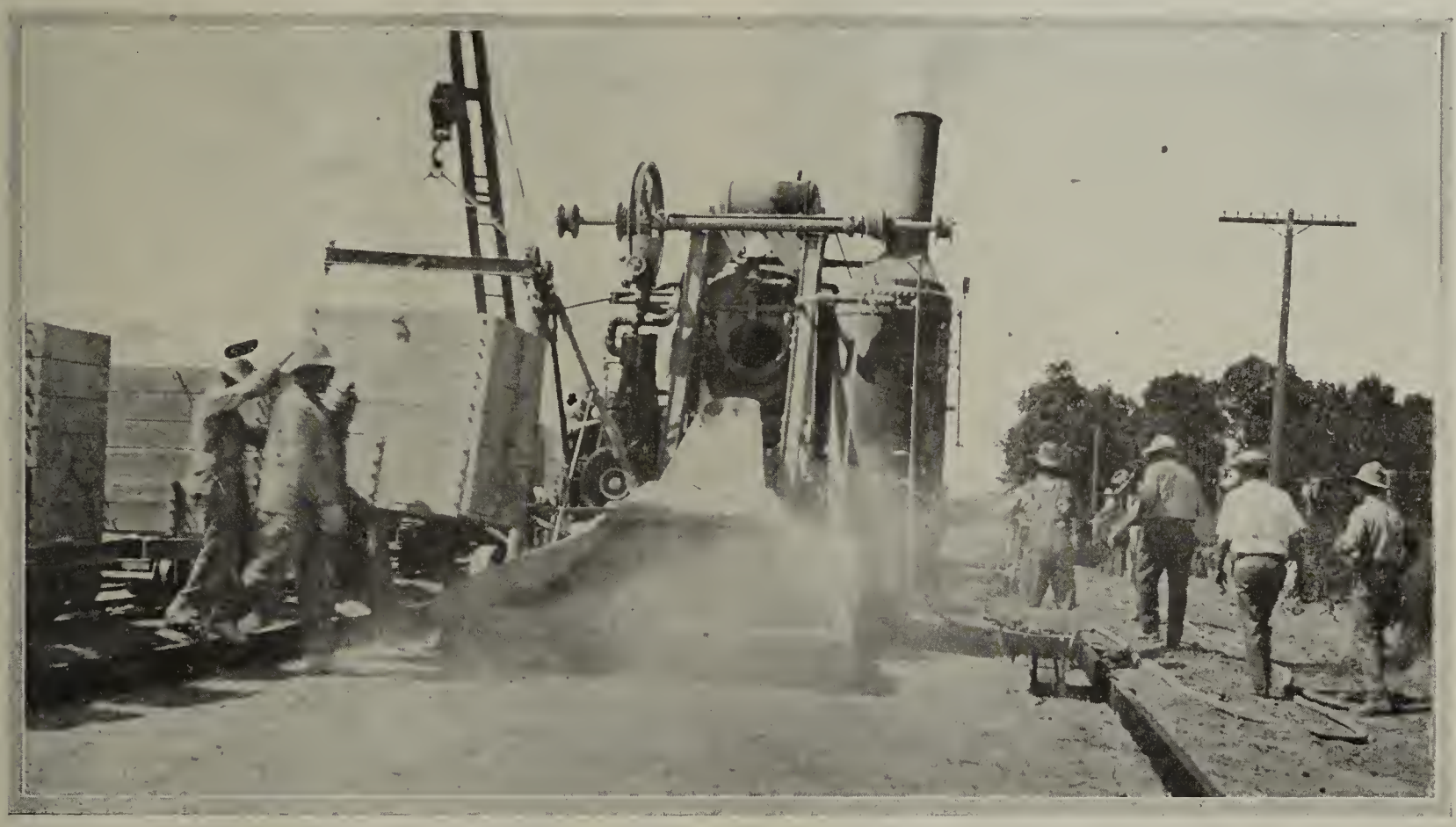
Concrete Road Construction in Illinois

Contract awarded in February; work started in April; three and three-fourths miles of monolithic brick and concrete pavement, 16 feet wide, completed July 1; 15 miles of road to be built this year; a record of 744 linear feet of concrete road in ten hours, from a single 4-bag mixer; more than a mile a week of concrete and brick combined. These are some of the high spots in a million dollar road contract near Paris, Ill., undertaken by Alan Jay Parrish, under the general direction of Horace Polk, State Engineer.

Route 12, Federal-aid road, 29 miles long, concrete and monolithic brick, from Ridge Farm to Marshall, was let to Mr. Parrish in February, amounting to considerably more than $1,000,000, in addition to 100,-

tracts, with independent organizations and different sources of supply for material and labor. The north job, brick, and the south job, concrete, are 14 miles apart at the present writing. His important men are on a salary-and-bonus basis, employed the year around, the aim being to build up a strong and permanent organization. In this the contractor has been signally successful. Employees who remain throughout the season receive a bonus amounting to ten per cent of their season's wages. Mr. Parrish believes that an experienced man on the job easily is worth ten per cent more to him than a new man. As a result of this policy the labor turn-over has been very small.

Into these two organizations the contractor has in-



Modern Concrete Road Construction—Swinging the Batch Box to the Skip

000 barrels of cement furnished by the state. Mr. Parrish is still a young man although he has been sixteen years in the contracting business. He started work in April, with a splendid organization. July 1 three and three-fourths miles had been completed and construction was proceeding at the rate of from $80,000 to $100,000 a month. During the month of June an average of nine carloads of material were used every working day and the estimate for the last half of the month amounted to nearly $48,000. In the face of a record like that, it will be worth while to make a brief survey of the man and his methods.

"I was brought up, you might say, in the banking business," explained Mr. Parrish. "When I started this contract I so laid out the work that I could get other peoples' money coming in at the earliest possible minute."

The contractor's program calls for the completion of 15 miles of road this year and on July 1 his work was up to schedule. The six miles of brick paving will be finished this year. Next spring another mixer outfit will be installed on the concrete job and it is expected that the entire work will have been completed before the end of 1923.

Mr. Parrish's method is to handle the brick and concrete road work as two separate and distinct con-

fused some of his own resistless energy and good will and has succeeded in awakening a spirit of rivalry between them, which is carrying the work forward at high speed. There is a standing offer of $100 to the outfit which breaks the other's record for day's output. The rivalry forced the record up from time to

Charging the Mixer

time until one day the concrete gang laid 744 linear feet, 16 feet wide and 8 inches thick, in ten hours. At the present writing the brick road gang has secured the consent of District Engineer F. E. Feutz, to set the machine at 750 feet and are going after the other record at the first favorable opportunity.

In the north job bricks are hauled one and one-half

Parrish Finishing Machine at Work near Paris

miles by truck and distributed along the side of the road. From there a gravity carrier, designed by the contractor, takes them to the center of the road, within convenient reach of the workmen. Material cars are unloaded into trucks by means of an unloading machine, also made by the contractor himself. This machine is provided with a hoisting device and 200 feet of cable, which are used in switching cars. The concrete pavement is "finished" by a Parrish Finishing Machine, designed by the same versatile contractor. Mr. Parrish's exceptional mechanical ability is of great assistance to him, not only in the designing of labor-saving machines and short cuts, but in determining whether he is getting full efficiency from his equipment, which is equally important.

Grading for both jobs is being done with a Western elevating grader and dump wagons, and Western plows and scrapers, the machine-outfit being sent from one job to another, as needed. Whenever the cut exceeds one foot in depth, the elevating grader is em-

Alan Jay Parrish (left) and His Superintendent

ployed. The excavation does not exceed 5,000 cubic yards per mile except in one heavy cut, which will be taken out next winter by steamshovel. An Orton & Steinbrenner crane, now handling material, will be converted into a shovel for the purpose. While the grading is in progress the 7-foot dirt shoulders, required by the state, are put in.

The road is divided into sections of approximately two miles each, the unloading outfit being moved about every four miles. For charging the mixer on the concrete road job the industrial railway bach-box system is used, material being hauled in batch-box trains of Western Railway Trucks, two batch-boxes to a truck, drawn by American Gasoline locomotives. In addition to grading tools on this job the equipment consists of four and one-half miles of industrial railway; one crane, five American locomotives; 60 Western trucks; 120 batch-boxes; one Austin mixer; one Parrish finishing machine; double unit pumps, roller, three teams, etc. On the north job are a Cube mixer, three motor trucks, one Huber steam tractor; one car unloader; double pumping units; 10 teams, roller and the necessary small tools.

It is characteristic of Mr. Parrish that every piece of equipment is overhauled each winter, put in shape for efficient work and painted. The expense is from 10 to 20 per cent of the cost price but the contractor thinks it is worth that to him to maintain his machinery at 100 per cent efficiency. His shop and warehouse where this work is done by his own forces has 10,000 square feet of floor under cover.

Concrete Piling That Can Be Sunk Without a Pile Driver

The Bignell-Jones concrete pile was shown at the exhibition of the National Railway Appliance Association, recently held in Chicago. It was exhibited by Woods Brothers Construction Company of Lincoln, Neb. This is a premoulded, reinforced concrete pile in column or sheet form that can be hydraulically sunk to bed rock without the use of a hammer. This result is achieved by forcing streams of water through pipes moulded in the pile. These pipes are placed so as to direct the main stream downward from the nose of the pile while secondary streams are directed upward along the sides of the pile. The force of these streams is made sufficient to erode or displace the material being penetrated so that the pile sinks into place by its own weight. The Woods Brothers Construction Company are already engaged in a number of important construction projects in which the Bignell-Jones Pile will be used.

How to Use Cal

"How to Use Cal" is the title of a folder issued by the Cal Chemical Co., Inc., Hagerstown, Md., in which is included descriptive matter setting forth the merits of "Cal," a chemical powder which is said to produce the set and strength of concrete in approximately half the time, without injurious effect on the ultimate strength. It also contains the favorable report of the U. S. Bureau of Standards.

Precast Stone Trim Produced for Baltimore Refinery

Casting and Storage Yards Elaborate—Batch Cars on Elevated Track Chute Concrete to Forms—Daily Output 600 Cu. Ft.

By J. Roscoe Sharp, Foreman Stone & Webster, Inc.,
Baltimore, Md.

The plans for the refinery of the American Sugar Refining Co. at Baltimore, Md., contemplated the use of precast stone trim, more commonly referred to as cast stone. For the entire project, planned require-

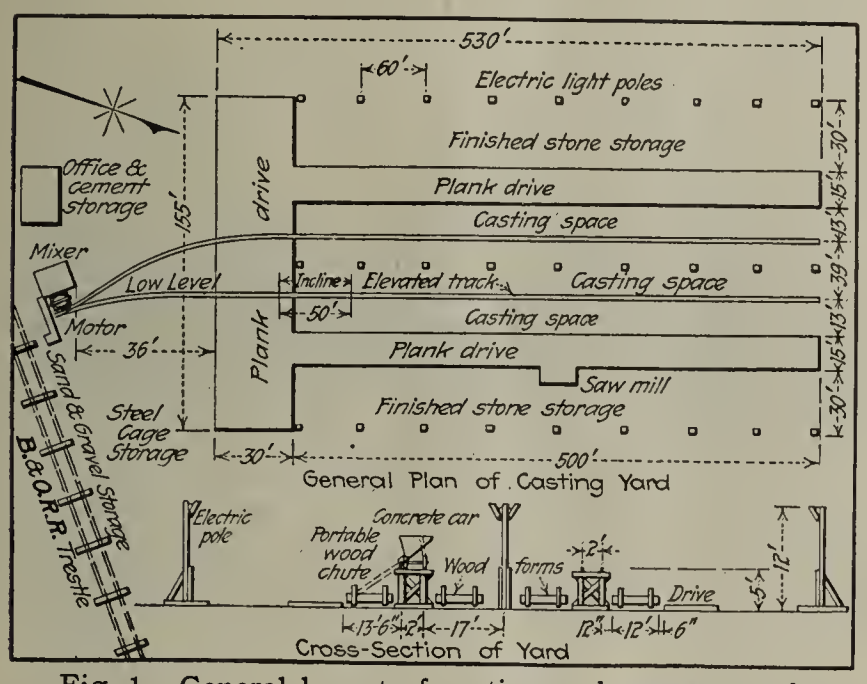


Fig. 1. General layout of casting and storage yard

ments were 40,000 lin. ft., or approximately 30,000 cu. ft.

The plant was designed on the basis of meeting the complete requirements within three months, and consisted (1) of an electrically-driven mixer of a capacity of 10 cu. ft. with attendant storage for concrete materials, elevated 5 ft. above the level of an industrial track; (2) two industrial tracks of a 24-in. gage, leading from the mixer up an 8 per cent incline to two parallel trestles 50 ft. apart, each 400 ft. long and

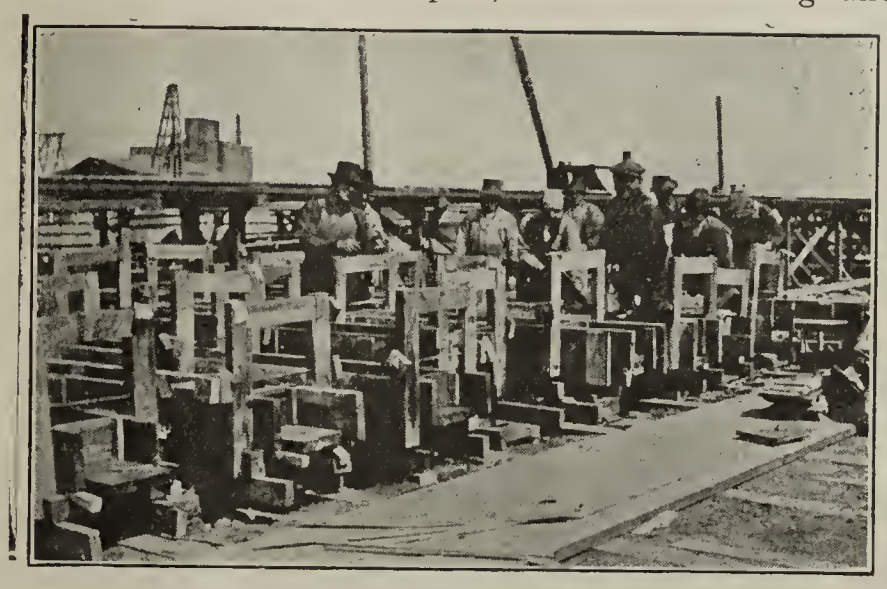


Fig. 2. Setting the Precast Stone Forms

elevated 5 ft. above the ground; (3) two industrial bottom-spout hopper cars; (4) a crane with a 30-ft. boom; (5) 1¼-in. water lines along each trestle, and (6) two 15-ft. plank roadways each 400 ft. long, for operation of crane and portable wooden concrete chutes.

Fig. 1 shows the general layout of the casting and storage yard, and Fig. 2 a general view of the forms. The forms were built knockdown of 2-in. material, and

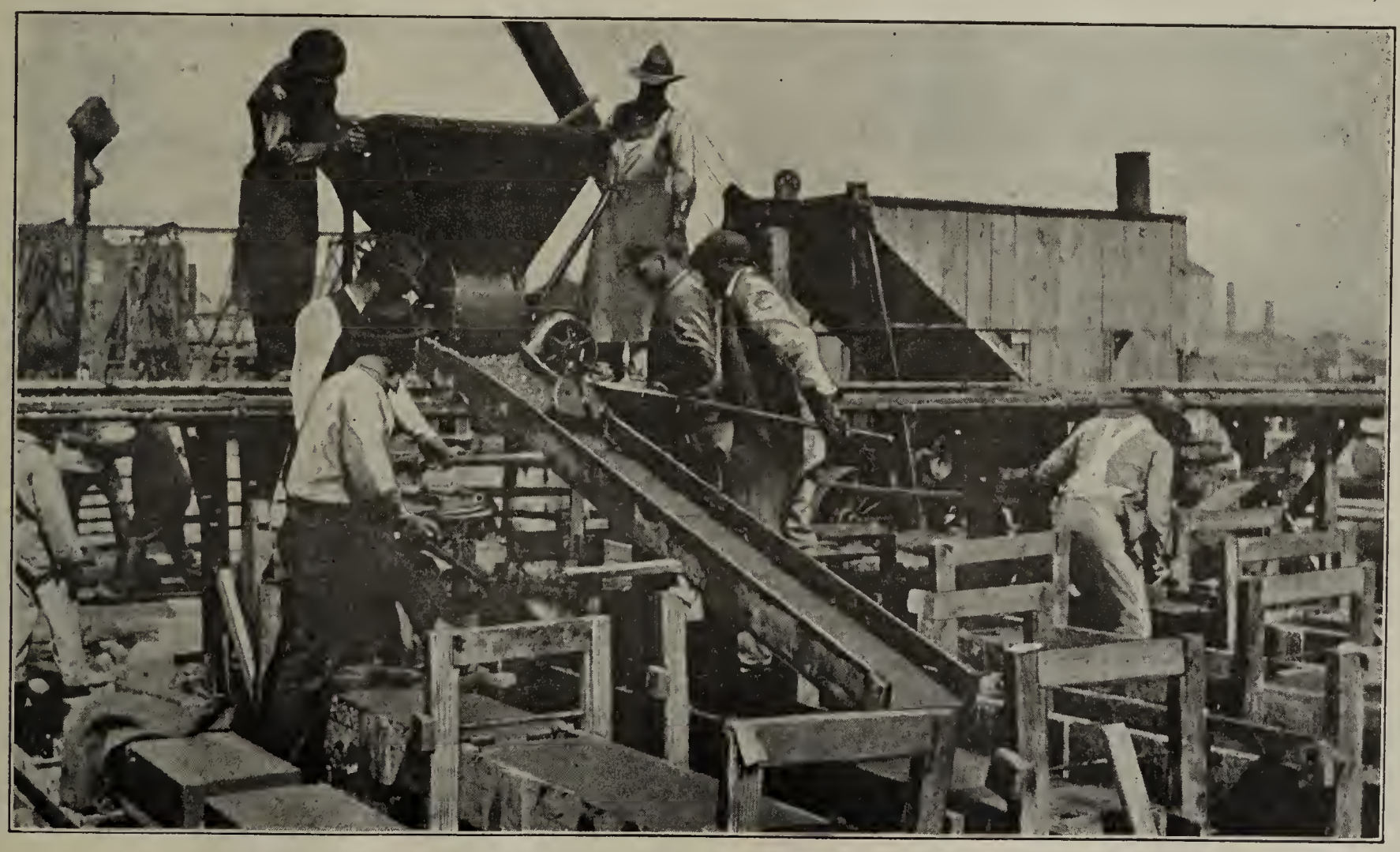


Fig. 3. Elevated Batch Car Chuting Concrete Direct to Forms

were held in place by yokes made of 2-in.x4-in. pieces and ½-in. diameter rods threaded at both ends. The form bottoms were set about 18 in. apart to give working space, and leveled on 4x4-in. sills. Sides, ends, and yokes were put on by carpenters and the whole again leveled and squared.

To insure a good face, all stone was cast face down. One inch of 1:2 mortar was first placed in the forms, then the reinforcing, consisting of four ½-in. bars made into cages using No. 1 wire. The 1:2:4 concrete was then placed by laborers, by chuting from the car on the elevated track through the wooden chutes. After finishing off the concrete, the stone was covered with burlap bags kept wet to prevent hair cracks. Twenty-four hours later the side forms were stripped and the stone was turned over onto 4x4-in. sills. This operation left the stone face up convenient for finishing. The finish was a neat cement wash applied by cement finishers with hardwood floats. After finishing, the stone was again covered with burlap bags kept wet.

At the end of four days the stone was handled into storage by the crane. All stone except those with a return face were cast with holes in the ends for convenience in handling with chain dogs. The storage piles were kept wet for ten or more days to insure the curing of the stone.

When the forms were erected, a linen tag was attached to each, giving the number of the stone. This number was transferred to the stone, using paint, just before stripping the forms. The system of numbering was such that all pieces of one section and one length had the same number, regardless of its location on the building.

The force employed consisted of thirty carpenters, thirty-six laborers, fourteen cement finishers, two crane engineers, and one general foreman. The output was 800 lin. ft. per day.

The construction work was done under the supervision of the construction board of the American Sugar Refining Co., C. T. Main, designing engineer, and Stone & Webster, general contractors.

Shovel Operated by an Oil Engine

Several months ago the Bucyrus Company, South Milwaukee, Wis., produced and added to its line of machinery a gasoline operated shovel of new and improved type, an outstanding feature of which was an ingenious method of operating the thrust without the use of an independent engine mounted on the boom, whereby, it is noted even more power is obtainable than with a steam shovel of the same size. Now the company has developed, after a long period of experiment, the use of a Diesel type engine for this shovel in which the important factor is reduction of fuel cost.

This new shovel, known as the 30-B oil shovel of this make will use any cheap low grade oil of high heat value that flows freely. Savings accomplished are noted as remarkable. The machine was under a severe test for some months under strenuous winter conditions both as a shovel and dragline and, it is stated, these tests have shown that the machine will consume 1¾ to 2¼ gallons of fuel oil an hour, which at 6 cents per gallon means a fuel cost of 10½ cents to 13½ cents an hour or between $1 and 1.25 a day of actual operation. The economies possible to users may be realized by comparison with a steam shovel of the same size, which it is said will burn about 1½ tons of coal in a 10 hour day. There is also saving in not having to haul water for boiler.

The engine is of the full Diesel type and is known as a mechanical injection engine developing 55 horsepower at the conservative speed of 360 revolutions per minute. The cylinders are 8½ inches by 10½ inches. It is a heavy duty, slow speed engine of strong construction and is well adapted to the severe service it must sustain in excavation work.

The Diesel engine is different from a gasoline engine. The fuel is injected into the cylinders in an atomized condition and at a constant pressure. It is fired by the heat developed by the compression of air in the cylinders on the previous strokes. There is no carburetor and no spark plugs and no outside heating apparatus.

Oil Engine Shovel at Work

The machine can be furnished to operate either a shovel, a dragline, a clamshell or a locomotive crane.

A Crusher Is No Better Than Its Lubricating System

"Nothing contributes more to the success of the Austin crusher than its force feed circulating oiling system, writes Austin Mfg. Co., 400 N. Michigan Ave., Chicago, Ill.

"The bottom plate of the crusher serves as an oil reservoir. From this reservoir oil pipes connect with a pump located in the wall of the main frame. The piston of the pump is attached by a connecting rod to the lower dust collar encircling the main shaft. The moment the crusher is started, the movement of the main shaft is transmitted to the pump piston and oil begins to flow in a positively driven stream into the eccentric bearing, flooding it with live oil. The gears are partially immersed in oil and are perfectly lubricated. The counter shaft bearings draw oil from chambers supplied by the oil thrown from the drive pinion onto the pinion hood. Supplementary lubrication can be supplied by additional oil reservoirs on the bearing caps.

"The lubricating system is but one of several exclusive features which places the Austin Gyratory Crusher in a class by itself. Catalog 29D just off the press, illustrates and describes them in detail. Write for your copy today. Recently our third and largest reduction in prices went into effect."

Easily Handled Concrete

Handling and placing costs are items which every concrete user must consider. Strength must not be sacrificed to speed, but quick and easy handling is essential. Increasing the amount of water in concrete will make it more fluid, but that in turn, means seriously decreased strength and danger of segregation. These two dangers must be avoided in order to produce high-class results, and the better-class firms all use hydrated lime as the material which will pro-

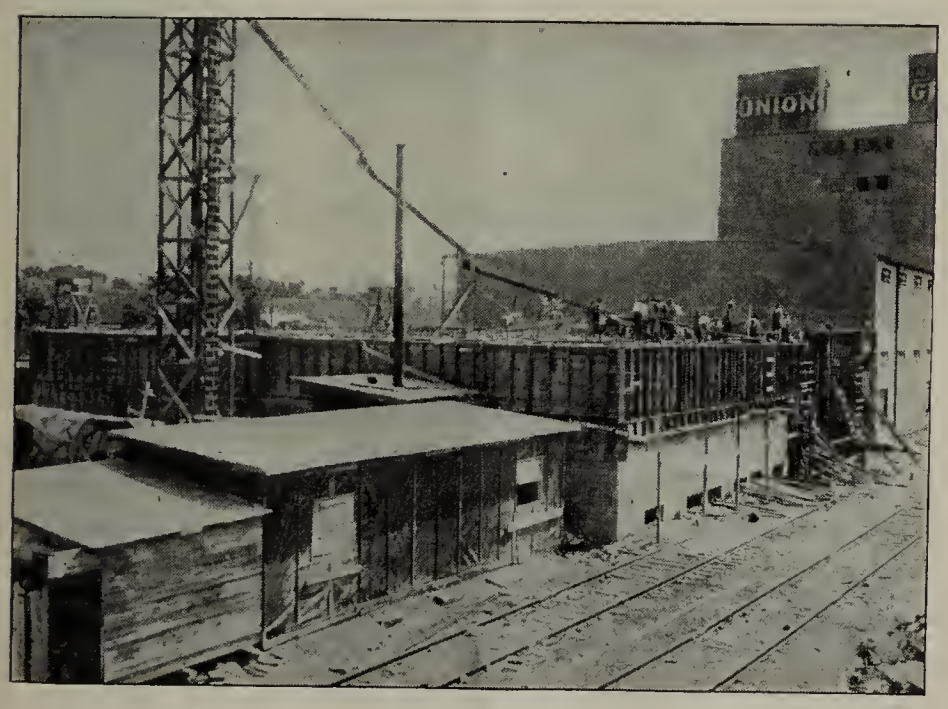
New Addition to Baldwin Piano Plant

duce the desired result of increased workability, decreased danger of segregation, and uniform, dense concrete.

Opinion of Large Concrete Construction Company

A representative of the Ferro-Concrete Construction Co., of Cincinnati, Ohio, stated before the American Concrete Institute that:

"My company, the Ferro Concrete Construction Co., has used both hydrated lime and lime slaked ourselves, and our superintendents prefer, of the two, to use hydrated lime. They found the hydrated lime handier on the job than any other kind. The question that naturally came up to us first was whether it would pay. When you add hydrated lime to concrete you are increasing the cost of the aggregate, but we have found that the increased cost is more than made up in the labor saving. We can use chutes where a percentage of about 5 per cent of hydrated lime is used, where we cannot use the chutes otherwise. We have had chutes that clogged up and caused a great deal of annoyance and trouble by our constantly having to clean them, and by the addition of lime we have been able to use the chutes under the same condition of slope with the hydrated lime and have had no trouble at all.



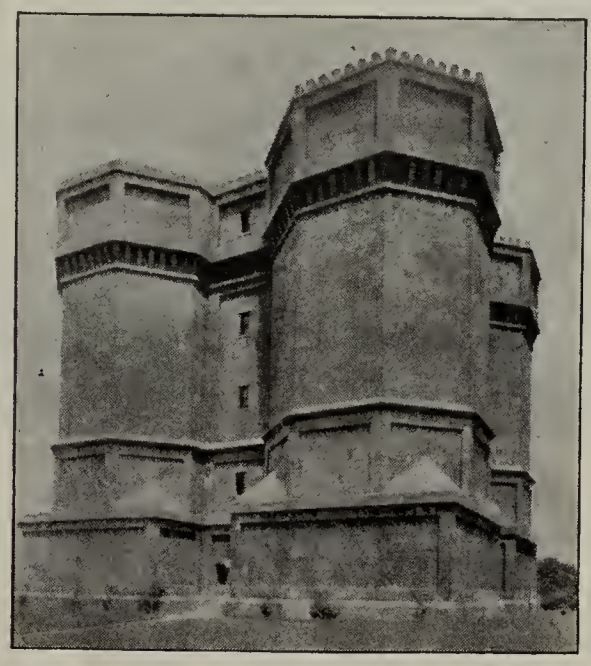
One of the many concrete buildings for the Ubiko Milling Co.

Labor Saving When Hydrated Lime is Used

"I believe that the resultant concrete looks better, that you do not have so much patching and pointing up to do afterwards. There is a labor saving at the time of placing and a labor saving afterwards in results. We also found it of advantage for a waterproofing material in so far as its affecting the strength of the concrete goes."

This firm makes it a standard practice to use hydrated lime, and the character of their work can be seen from the pictures. The light uniform color of the concrete makes the work more attractive, and its smooth, dense appearance gives the impression that it is substantial and strong. All these factors makes for success, and a high reputation for the company that erects the structure.

The three pictures here shown offer good examples



Concrete shell around water tanks

of the class of work done by the Ferro Concrete Construction Company. Several types of construction in various stages of completion are shown. It is interesting to note the flat slope of the chute used on the Ubiko Milling Company job. The concrete shell around the water tank is thin, which demands high-class concrete, uniform and dense. In fact, none of the work shown is of a type where mediocre concrete could be tolerated in any part.

Hydrated Lime

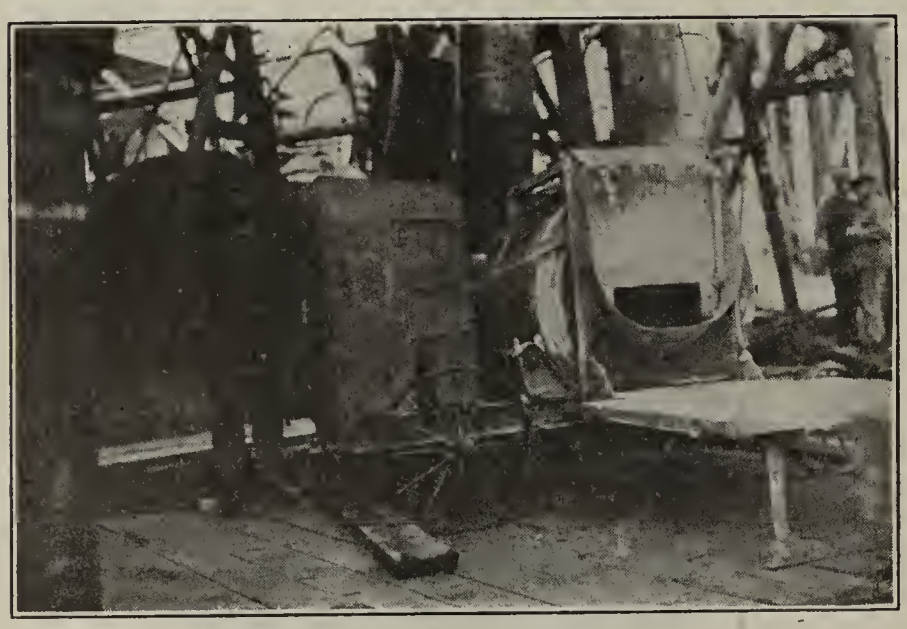
"There is a growing tendency to use hydrated lime in concrete in mixtures for various purposes. It should not be used to displace any part of the cement deemed necessary to give a good product. It should be added to the cement. The amount which it is generally considered advisable to use is limited to 10 per cent of the weight of the cement. Some manufacturers of purely ornamental products use as high as 25 per cent by weight of the cement. It is used in quantities as high as 15 per cent in building stone manufacture."

"Hydrated limes give a more plastic mixture—a

mixture that lubricates itself in placing. It gives a concrete of lighter color. It acts as a void filler. Tests of effect upon strength are not yet conclusive." —*Concrete Stone Manufacture.*

Small Mixer on Big Job

That large jobs do not always call for large machines is recognized by large contractors—namely, the Stone & Webster Corporation, who are building an addition of considerable size, as well as 400 ft. of concrete discharge tunnel, in connection with the Queensboro Gas & Electric Company's plant at Far Rockaway. For concrete work, which consists of foundations and footings for the building extensions and the tunnel, they are using a 1-bag mixer with which they are pouring 50 cu. yd. of concrete a day. The ease with which this small mixer is moved from

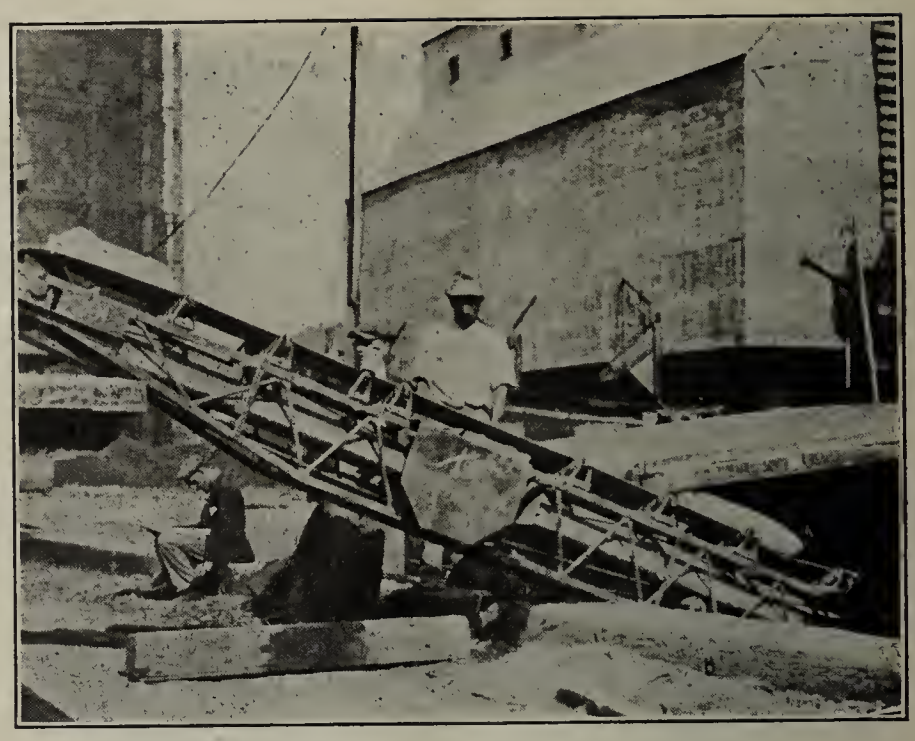


place to place, as well as its sturdiness, makes it a very efficient machine on this class of work, where, though the yardage may be considerable, it is more or less accessible.

An obstacle with which the contractor has to contend on this job is the maze of overhead wires which parallel the site of the tunnel. In order to put down the 4-in. splined sheathing a mast carrying a 5,000-lb. steam hammer was rigged on rollers close up to the sheathing. A 2-drum hoisting engine, which travels, with the mast clearing the poles, handles the hammer. For driving piles where the wires will not allow this rig to be put down by digging underneath and then driving down with a 500-lb. hammer rigged as a yo-heaver to a gin pole. B. M. Cowan is superintendent on this job.

Conveyor Shows Low Cost in Handling Bag Cement

To get a comparison between the cost of time necessary to handle bag cement by hand labor and by mechanical means, the United States Constructural Steel Company, contractors on the new Hell Gate power plant of the New York Edison Company, recently



tried out a 33-ft. 18-in. smooth belt conveyor run by a 5-hp., 2-phase electric motor. The cement is received in lighters carrying about 9,000 bags each. One of the illustrations shows the interior of the lighter and the other the exterior. The exterior picture was taken when the tide was at low ebb and shows the conveyor working at an angle of about 30 degrees. The unloading from the lighter and the

loading of the trucks by hand required from 12 to 15 men, depending upon the tide, and from 15 to 25 minutes per truck. By means of the conveyor one truck was loaded using 8 men in an average time of 7 minutes. The trucks were loaded with 150 bags each, and the saving of truck time as well as labor was considerable. Also when hand labor is used, unloading cannot be done if the barge is deeply loaded during about two hours of low water. The above figures are the average for a week's run of the conveyor.

Reinforced Concrete Simply Explained

A new book entitled "Reinforced Concrete Simply Explained" is ready for distribution by the Oxford University Press, American Branch, 35 West 32nd St. New York, N. Y. It is a simple book on reinforced concrete which can be understood by comparatively non-technical readers. It appeared first as a series of articles in Concrete and Constructional Engineering, London, to whom the author, Oscar Faber, C. E. and publishers are indebted for permission to reproduce it in book form.

Quality Control in Cement Manufacture*

By Richard K. Meade, Consulting Engineer, Baltimore, Md.

Contrary to the general belief, the question of the quality of cement is more often a mechanical than a chemical problem—or rather perhaps one of the relation of the mechanics of the process to the chemical composition of the product. The connection between the chemical composition of cement and its physical properties is now so well understood that there are few instances where the poor quality of the cement is due to a lack of knowledge of what the chemical composition of this should be. Generally speaking poor quality is due to circumstances which interfere with the attainment of the ideal composition by the chemist. In speaking of composition in this paper the term is not limited to the mere analysis of the cement, but includes the proper combination of the elements to form the so-called cement clinker.

The problem of manufacturing good clinker in laboratory quantities is extremely simple. It is merely necessary to grind finely a properly proportional mixture of argillaceous and calcareous substances and then to ignite the mixture to the point of incipient vitrification for a sufficient time to allow proper chemical combination of the elements composing the mix. All the details of the process are well understood by cement chemists—the proper relation to be had between the argillaceous and calcareous elements, the fineness necessary to secure intimate contact and the degree of burning to promote combination are all matters of common knowledge in the industry. When it comes to handling large quantities of natural materials and to manufacturing cement economically, however, the problem is vastly complicated. To begin with the raw materials, these generally vary considerably in chemical composition in different parts of the deposit and the method of accurately sampling and proportioning these materials is one of the most troublesome problems with which the cement manufacturer has to contend. The question of the degree of grinding is generally limited by the mechanical equipment provided and is always influenced by the question of economy. The problem of burning is much simpler than the other two and is usually merely one of securing experienced and conscientious kiln attendants.

These three primary operations of cement manufacture bear a general relation to each other. Some years ago I called attention to the fact that, assuming the chemical composition to be correct, there is a very definite relation between the fineness of the materials, the temperature of burning and the time at which the materials are subjected to this temperature. I can possibly best illustrate this relation by means of a mathematical formula thus

$$F \times D \times T = C$$

In which F represents the fineness, D the temperature, T the time, and C clinker (a constant quantity). It will be seen that if C is a fixed quantity the others can vary among themselves and still equal C. Thus with a coarsely ground mixture the time or temperature of burning one or possibly both, must be increased to secure proper combination. Similarily if the time in the kiln is short this must be made up for by higher temperature or finer grinding.

If the fact that the composition of the mixture of argillaceous and calcareous substance can vary is considered, another variable is added to the equation. It is, of course, well known that it is much easier to burn low lime cement than high lime cement, in which case coarser grinding satisfies. In actual practice, the details of cement manufacture, therefore, are a general compromise to suit local conditions between chemical composition, fineness of grinding and degree of burning.

I am not going to take up any time today discussing the question of fine grinding of the raw materials or the degree of burning, beyond saying that fine grinding and harder burning as indicated above will tend to correct faulty composition in some instances. The importance of fine grinding of the raw materials and of proper burning are, of course, better understood and when these are the cause of poor quality the remedy is evident.

My own experience indicates that the problem of making cement uniform high quality is largely one of *absolute* control of the chemical composition of the mixture fed to the kilns. Occasionally I have met with a plant where the raw grinding or burning equipment was insufficient, but for the most part the failure to control the chemical composition of the mix has been responsible for the irregular quality of the product.

Chemical analysis of the cement does not always show the trouble particularly when this analysis is confined to a sample representing a large quantity of cement, such as a bin of several thousand barrels or a day's run because such a bin of cement may be the average of several hours of very high limed and consequently unsound cement mixed with several hours of low limed cement; the average of the two being often near the desired chemical composition but the physical properties of the resulting cement pertaining something of the undesirable characteristics of both the high limed and low limed clinker.

Such a result is quite apt to occur in the dry process, whereas chemical control is generally a matter of examination of a mixture already made rather than of two materials about to be mixed. It is, of course, well known to most cement manufacturers that the routine tests of the dry mill laboratory are post mortems rather than diagnoses. They are of no value so far as correcting the composition of the particular lot of raw material under examination is concerned but serve as a guide to the making of succeeding lots.

By far the larger number of mills, both wet and dry, make their mix by means of what are, in the vernacular of the industry, known as *"readings."* That is, samples of the mix are drawn from the grinding mills at stated intervals of time and in these samples the carbonate of lime is determined. If this is found to vary from the desired standard, no correction can as a rule be made in that portion of the mix which has already been prepared, and the test serves principally as a guide to the proportioning of succeeding lots, etc. When the mix is controlled by such a process, the chemist finding his mixture too high or too low in lime (as shown by the reading) decreases or increases his limestone to correct his proportions. In the dry process this often has the effect of sending his composition to the opposite extreme, with the result that while his low lime and high lime clinker will average properly very little of it is *per se* of correct composition.

At many dry process cement plants, the question of chemical control is largely one of good judgment on

*Paper presented at annual meeting of the Portland Cement Association, Atlantic City, N. J.

the part of the chemist rather than of chemical test. For example, let us cite the case where a limestone and shale plant is supplied with rock by one large steam shovel. The shale is regular but the various strata of limestone differ much in chemical composition. Added to this variation is also the fact that 3 or 4 feet of clay overlying the limestone is not stripped from the latter but is blasted down with it. Deep well drills are used and the shots are large, each representing several months' supply of stone. All stone is sent direct from the shovel through crushers into a relatively small storage bin and the mix is controlled entirely by "readings" taken from the tube mill discharge. Let us suppose, as frequently happens, the shovel is working in the morning on clean limestone comparatively free from stripping. At noon, it encounters a limestone mixed with stripping and by night it has worked through the stripping and is back on the clean stone. What happens to the mix is this: Sometime during the afternoon the sample drawn from the tube mill shows the mix to be overclayed and the chemist accordingly decreases the shale. The orders to make this change probably reach the raw mill about the time the shovel reaches clean stone again with the result that the next sample drown from the tube mill will show the mix over-limed, etc. At this mill, the mix would generally be wrong but for the visual inspection and good judgment of the chemist. This condition is by no means unusual and while probably not existing often in quite such an exaggerated form, does occur in a more or less modified form at many mills.

In my opinion, it is *everlastingly* to the credit of the American cement chemist, that he can make cement *superior* to any in the world with the crude methods often supplied him. He may not be as "long" on theory as his English and German confrerers but for the exercise of good, hard, common sense and rare judgment he has them both, to use a slang expression, "backed off the boards."

So far as quarrying methods are concerned, the steam shovel and the deep well drill are likely to stay, and it is also in most instances more economical to include the overburden in the blast rather than to strip; at the same time, it is evident, that these three improvements in quarry efficiency have increased materially in most instances the difficulty of securing a uniform mix. The big blast throws down the entire vertical face of the quarry in one jumbled heap. If it served also to mix the various beds intimately it would be of advantage, unfortunately the opposite is generally true and the beds remain almost as separate, but not as easily *segregated*, after the stone is blasted down as when in the position left by nature. In the case of the old method of quarrying by means of 16 to 20 foot benches, the beds were usually blasted down in some sort of order and could be quarried uniformly. The steam shovels also confine the stone supplied the mill to that obtainable from one or two points in the quarry, while with hand loading the stone can be obtained from almost the entire area of the quarry.

If the overburden could be intimately mixed with the stone there would generally be no objection to its being blasted down with the stone. Unfortunately this result can not often be obtained and the overburden lies over part of the rock only.

With these new conditions occurring in the quarry, provision must be made at the mill to take care of the irregular supply of stone and clay sent to the mill by the shovels. The influence of occasional variations in the composition of the raw materials are designed to be taken care of at most plants by storage bins of varying forms and sizes.

Usually the shale or clay supplied the mill, whether obtained by means of shovels or hand, is of regular composition. Sometime with clay the moisture content needs careful supervision. A few mills use a calcareous shale in which the lime content varies over quite a range. The use of such shale always greatly complicates the problem of controlling the chemical composition of the mix by introducing two variables instead of one.

The employment of a large stone storage divided into two or more bins seems to be the most feasible method of securing a uniform raw material. In many instances, however, such stones are poorly designed. If we place rock continuously on the middle of a pile and draw at the same time below from the center of this, we will obtain pretty much the same stone that is being delivered to the pile and very little if any mixing will occur. Even where the discharge is not directly under the point of filling this flow of material between the two points occurs. In designing a stone house, therefore, this should be divided into at least two bins but I do not think anything is gained by numerous small tanks or bins.

Another action which should be kept in mind is the so-called segregation of materials in the bins. If a mixture of coarsely crushed limestone is fed from an overhead source into the center of a pile it will be found that the coarse material will roll to the outside of the pile while the fine material will lie where it falls. If the pile is tapped from the center the first material drawn is almost entirely the fines while the coarse material is the last to be obtained. As the fine material usually contains the srtipping and is always lower in lime than the coarse material, it will be seen that the composition of the material obtained when the pile is first tapped will be much lower in lime than that of the last portion obtained.

Many plants employ what are termed blending bins, consisting of large tanks in which the coarsely crushed material is stored. My observation has been that these bins instead of blending actually segregate, for the reason given above.

It has always seemed to me that the traveling crane and grab bucket afford excellent methods of storing limestone. With this outfit the material as acquired can be uniformly distributed over a large pile. There is no segregation of fines and coarse and the reclaiming can also be distributed over a large area. It is a simple matter for the chemist to work out for the crane operator a cycle of filling and emptying such a storage which will give uniform material and leave nothing to the judgment of the operator.

Another excellent storage is one consisting of several long rectangular and fairly deep bins filled by means of an overhead belt conveyor. This latter is in turn equipped with a traveling tripper. This tripper is so designed as to move at a regular rate slowly back and forth over the entire length of the bin and spread the material in uniform layers over this. If the bin is relatively narrow and the openings below are alternately to each side of the center line, the segregation between coarse and fine material is negligible where the stone is drawn from several openings.

For those who prefer a pan conveyor or bucket carrier to the belt conveyor, the buckets can be arranged to deposit the material at a number of points in the bin. No doubt, other methods of securing the same result are available. Where a silo storage is employed, if the number of bins is sufficient to permit it,

better results will be obtained by filling or emptying a number of these at the same time by some such method as I have suggested, rather than to fill and empty in rotation.

So much for the form of storage. Another fact which should be borne in mind, is that the finer the rock is crushed, the better mixture will be obtained and the less segregation will occur in the bins. For this reason, I would suggest crushing the materials as far as practicable before storage.

For determining the proportions of the two materials where the mixing is done directly after the large stone house, two methods are generally employed. One is to obtain a sample of the contents of the bins of clay and limestone and mix the two as indicated by the analysis of this sample. The other is what is generally designated as the "reading" method and consists in mixing the two materials according to the results obtained from a determination of the carbonate of lime in the mix after this has been ground in the mill. In spite of the fact that it is apparently much the less scientific of the two methods, the second one will usually give better results. This is because of the difficulty of properly sampling material in large pieces mixed with fines and intermediates.

The only method of sampling such material which will give accurate results will be some system of crushing and quartering in several steps such as is used for ore sampling and this would involve an expensive sampling plant. As an illustration of such a plant, let us suppose that the material came from the crusher in a pan conveyor. Arrangement could be made to trip every tenth bucket into a small crusher which would crush to say 1 inch and under. The discharge from this crusher would then be sampled and the sample say crushed to ¼-inch. This ¼-inch material in turn would be sampled and the sample crushed to 10 mesh. The fine material could then be sampled and this final sample ground to the necessary fineness for analysis. It will be seen that such an arrangement would involve handling quite a lot of material.

In a cement plant using 1,000 tons of stone per day the first sample would amount to 100 tons to be crushed to 1 inch, the second to 10 tons to be crushed to ¼ inch, the third to 1 ton to be ground to 10 mesh and the fourth to 200 lbs. to be ground to laboratory fineness. It is doubtful if accurate results could be obtained with much greater fractions. It will readily be seen that the equipment necessary for such quantities is beyond that now available in cement mill laboratories.

The methods necessary for securing uniform rock at the mill are the same whether the wet or dry process is employed and to my mind the desirability of such a supply of rock of uniform composition is as great in the one process as the other. In the older wet process plants, provision was made for adding clay or marl as desired to the ground slurry before this was pumped to the kiln supply basins. Today, however, when necessary to correct the composition of the slurry, the general practice is to mix two or more tanks to give the desired results, so that as far as the mix goes, the two processes approach each other more nearly than they did when the raw materials of the wet process were marl and clay. In the matter of chemical control, there are unquestionably much better facilities provided at most wet process plants than there are in the general run of dry process mills. When difficulties of controlling the mix do occur in wet process plants, this is usually due to too few or too small slurry basins and kiln feed tanks or to improper or insufficient agitation.

I have always felt that the methods employed to control the mix at most dry process plants were insufficient and that a system of correcting tanks planned after those of wet process plants could be employed to advantage. If the grinding is done in two stages, such as with ball and tube mills, I would suggest the use of two sets of tanks or bins. One set of at least four, and better, six or eight tanks to be placed after the preliminary mills (ball mills) and one set of four or more after the secondary mills (tube mills). The tanks in the first set should be sufficiently large to take care of at least four hours run of the mill. The system should be provided with an automatic sampler so that the contents of each tank can be sampled as ground. Where ample rock storage had been provided to give fairly uniform rock, the four tanks could then be used in this manner. One tank would be filling, the second tank would be under test and the third and fourth tanks would be used straight, or mixed if necessary to give the proper composition. When analysis proved a tank to be of incorrect composition it would be necessary to so proportion the next tank that the two could be mixed so as to give a mixture of correct composition. The second set of tanks would receive the fully ground material and these should also be provided with automatic samplers. They serve as a further means of correcting the mix when necessary by blending the contents of two or more tanks as the pulverized material is sent to the kiln. The mixing here is not as thorough as would occur when the two materials were ground, but still fairly good mixing would occur when screw conveyors were used to carry the mix from the tanks and considerable mixing would also be effected in the upper part of the kiln before the material began to form into balls.

At some plants, it would no doubt be found most convenient to use such a series of tanks for mixing. That is, to grind the materials separately to 10 to 20 mesh before the mixing is done. In this case certain tanks would be set aside for limestone and certain tanks for clay and both materials would be sampled automatically and mixed according to the analysis of these samples. It is comparatively easy to secure an accurate sample of 10 or 20 mesh material, while it is extremely difficult to obtain anything which will properly represent material crushed only to one inch. So that this system of sampling, analyzing and mixing will do with 10-mesh material but will not give satisfaction with one-inch material. The statement that the finer the material, the easier it is to sample accurately will hold good for all materials.

No doubt various modifications of this system would be devised to suit local conditions. For instance, at certain plants it might be found best to mix partly by analysis and then to do the correcting by adding to the contents of the tanks as drawn as small amount of clay or limestone ground to 10-mesh. I am not trying to outline a plan to be followed by all plants, but merely to indicate lines along which such a system may be worked out. The cost of operating such a system would be low and the initial investment small. I believe the saving in other lines aside from quality would pay for the installation and upkeep of the system. Such saving would include fuel required to burn over-limed mix, power to grind under-limed clinker, labor due to greater kiln outputs, greater life of kiln linings, etc.

In the earlier paragraphs of this paper, I have shown how the various steps in the process of cement manufacture bear one on the other. From this it will be evident that if there are shortcomings in one step

these must be made up for in the next. If the composition is irregular, the grinding of the raw materials must be carried to the degree of fineness necessary to give sound cement from the high lime mixture as well as from the low lime. Every chemist knows that where the lime is high, much finer raw grinding is required than where it is low or even normal. In order to make sure of sound cement, the chemist must therefore grind finer where occasional runs of high lime material are encountered than where the mixture is constant. The proper fineness of the raw materials are therefore influenced to some extent by their composition.

The proper burning of cement is largely one of feeding the material and fuel to the kiln at a regular rate. If the composition of the mixture is constant, it is evident that if the material is fed to the kiln at a regular rate and the kiln is kept at a definite temperature and revolved at a constant speed the resulting clinker will be uniformly burned. The trouble with the burning is, first, that the composition changes, requiring a higher temperature or a longer time in the kiln and, secondly, that the rate at which both raw material and coal are fed to the kiln is subject to violent and sudden fluctuations, or in other words, both coal and raw material "flood." I believe that where trouble with the burning results much of this can be eliminated by designing proper feeding arrangements for both raw material and fuel. The irregularities due to change of composition come gradually and can be kept up with, while the feeding of the raw material is usually sudden and the extra load of material occasioned thereby is hard to catch and properly burn. The arrangements for feeding slurry to the kiln, where this is done by positive means such as buckets and scoops, are excellent and something of the same sort is desirable in the dry process.

The qualities most desirable in cement are soundness, strength and uniformity in the rate of setting and hardening. All are dependent to a marked degree on chemical composition the fineness of the raw materials and the burning. These three steps are therefore the ones which must be under perfect control if quality cement is to be produced. I regard the chemical composition as the keystone of the arch. Unfortunately, it is the step least under control. While there are many plants where unsound or quick setting cement is a rarity, even here there might be an appreciable improvement in quality by a closer regulation of chemical composition. Most cement chemists are playing safe, as it were, rather than attempting to attain any ideals. Perfect control of the composition would enable them to make cements much higher in lime than they do at present, with the result that their clinker would be easier ground and the resulting cement stronger and more uniform in setting and hardening qualities.

Concrete Flower Pot Machine

Numerous inquiries have come to the office of Cement Engineering regarding a machine for making small concrete flower pots similar to the clay pots in common use. The Spokane Concrete Flower Pot Machine Co., Inc., Box 806, Spokane, Wash., has placed on the market a machine for making concrete flower pots from 2 to 12 ins. in size. The pots made on the machine are of excellent quality and attractive in appearance.

A Well Organized Concrete Plant

River Between Mixer and Work Furnishes Real Problem

Isolation by the Illinois River from the railroad was the salient feature which Green & Sons Company had to consider in designing their concrete plant laying out for the construction of Lock No. 4, near Marseilles, Ill., for the State of Illinois. This lock is part of the Chicago to the Gulf waterway project.

As described in the September issue of Successful Methods, a temporary trestle so built that it can be

Unloading Bulk Cement from Box Car

taken out in sections when the rapid and frequent rise of the river or ice jams make it necessary, was built to overcome this isolation. One of the photographs shows the bridge with guide ways for trucks to prevent collisions on 12-ft. roadways. Overhead, and directly in line with this bridge may be seen the cableway. When concreting is stopped this fall the bridge will be removed by means of the cableway and replaced in the spring as soon as the run-off permits. In this picture the concrete plant also may be seen.

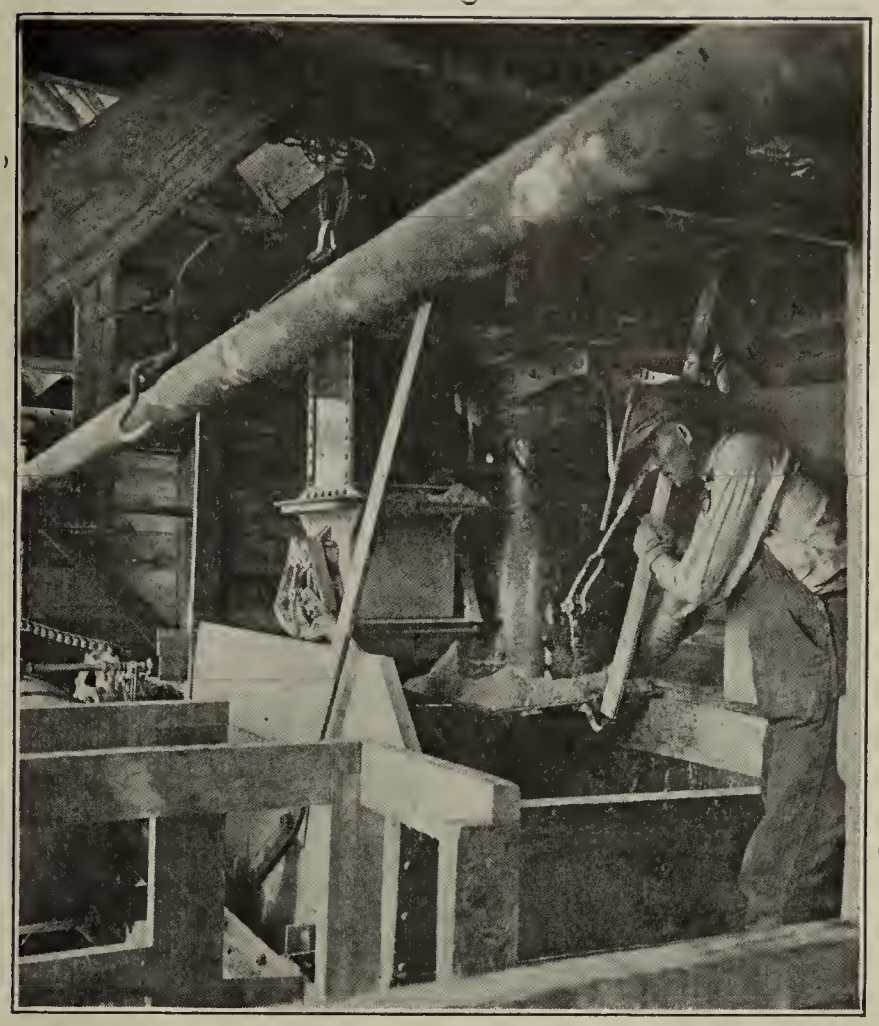
A fleet of six 2-ton trucks with automatic dump bodies handle 1 cu. yd. of mixed concrete over the bridge and discharge into a hopper controlled by a gate and through chutes to the wall forms, the base of which is 50 ft. below. The trucks average less than 10 minutes for the round trip from mixer to dump, an average distance of about 4,000 ft.

Pit run gravel is received in dump cars which discharge into the inclined bins. Underneath these bins there is a belt conveyor which carries the gravel to a bucket elevator where it is raised to bins above the mixer. Cement is received in bulk and one of the illustrations shows how a power shovel handles the cement into the boot of the bucket elevator which

handles it to the bins above. For delivering the cement from above to the hopper which charges the mixer a steel cylinder is used. For admission of cement to the cylinder there is a roller gate above, and a slide gate below empties the charge into the hopper. Proportioning or measuring is thus done in the

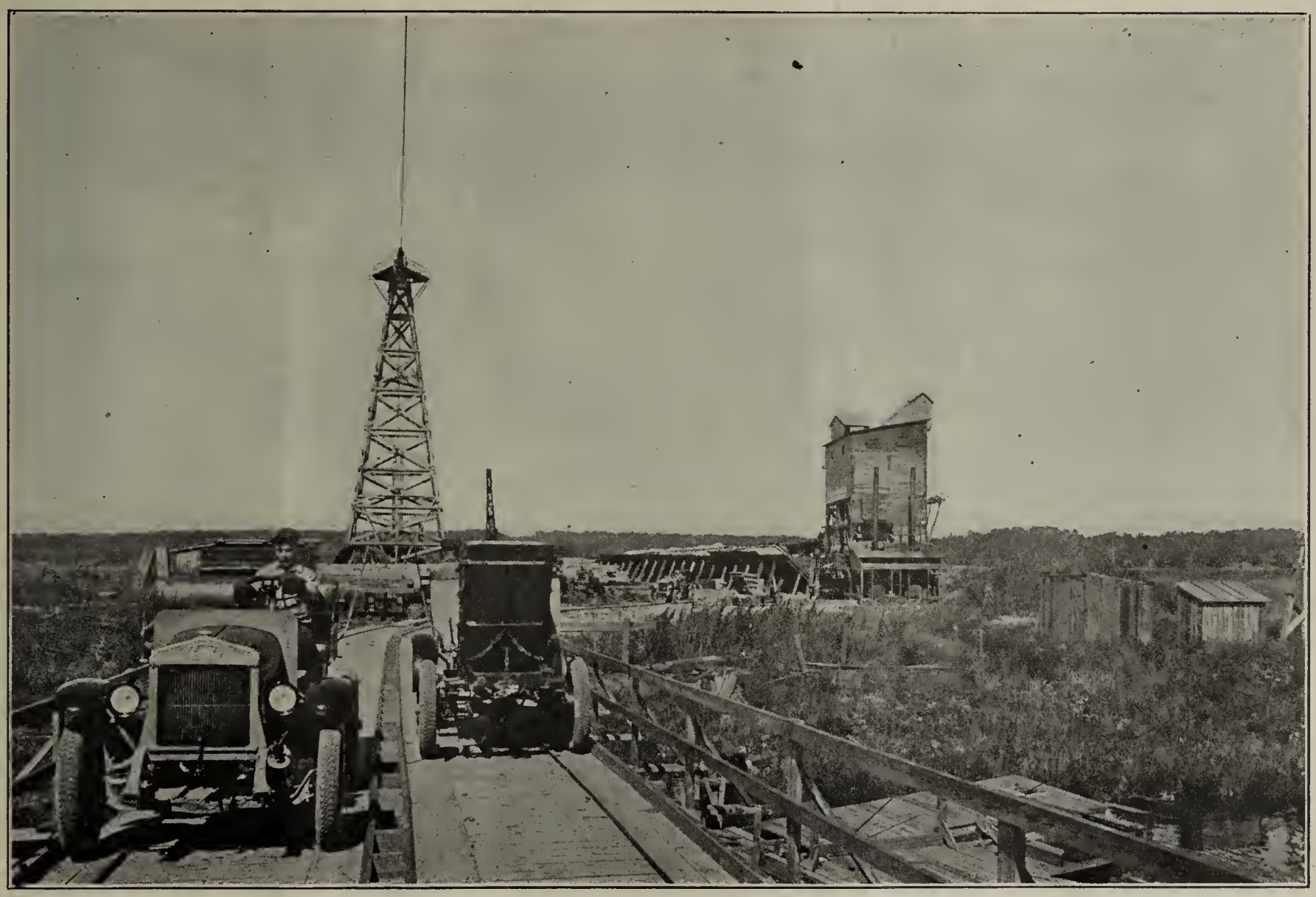
Dropping the Concrete into the Wall Forms the Base of which is 50 feet below

cylinder. By means of small circular sheels fitting the bottom of the cylinder, the mix may be varied from 1.1 bbl. to 1.3 bbl. to the batch. Two 1-yd. concrete mixers complete the plant, which has been in successful operation since the work of concreting began several weeks ago.



Proportioning Cylinder for Cement which Discharges into Charging Hopper

The superintendent of the work is Roy Shackleton, and the photographs were taken by R. A. Bonnell, engineer for Green & Sons.



Temporary Bridge Over the Illinois River. The Concrete Plant May be Seen in the Background

Long-Span Concrete Roof Arches for Chicago Garage

Arch Ribs Built as Polygons Save Expense in Forms —Cost Little More than for Wood Truss— Cold Weather Concreting

The largest concrete roof arches ever built are believed to be those of a Chicago garage, the arch ribs of which have a span of 103 ft, 7½ in. over the outer faces of the supporting piers. The building is a motor truck garage and distributing station at 4820 Cottage Grove Ave. for the dry-goods firm of Mandel Brothers. It is 103 ft. 7½ in x 161 ft. 4 in, in plan and it was desirable to obtain an unobstructed floor area and ample exterior light at reasonable expense. There are eight concrete arches of the span noted, supported on pilasters in the brick walls; at one end is a 65-ft. arch on concrete columns, in order to allow of an upper floor across this end of the building. All arches have a rise of 17 ft. and are spaced 16 ft. c. to c. The cut herewith shows an interior view of the completed structure.

Each main arch is a concrete rib 11½ x 24 in. in section with a short vertical stem at each end seated on a concrete cap on the 17-in. brick pilaster. It is reinforced by three ⅞-in. rods in top and bottom, with stirrups spaced 3 ft. apart, the longitudinal rods being hooked into a spiral at each end of the arch and having their ends hooked at the lap splices. The intrados has nominally a radius of 90 ft. but actually the arch is polygonal, with 10-ft. sides, this arrangement avoiding the expense of curved form work. In the 65-ft. arch the radius is 42 ft. A single 2½-in. tie rod with turnbuckles forms the lower chord. At each end of the tie rod is a nut and bearing plate, the plate at one end taking a bearing against the steel spiral and being embedded in the concrete, while at the other end the plate bears against the outer face of the rib. This rod is 14 ft. above the floor, and to prevent sagging it is supported by five ⅜-in hook hangers whose upper ends are fitted with washers and embedded in the arch rib. Turnbuckles provide for adjustment of the hangars. Details of the ribs and forms are given in Fig. 3.

On each side of the crown are two lines of longitudinal concrete beams or struts, 8 x 6 in. section, formed between the ribs and extending to the end walls. Upon these rest the wood framing of continuous skylights or monitors 12 ft. wide. This arrangement gives a good distribution of light over the entire floor area, as the roof design eliminates all interior obstructions. Pivoted sash in the sides of the monitors provides for ventilation.

Wood rafters were planned originally to be carried by timber strips bolted to the sides of the arch ribs, but a simpler construction was adopted by seating the ends of the rafters in the ribs. For this purpose the rafters were supported by the forms and the concrete was poured around them. They are 2 x 10 in., spaced 2 ft. c. to c. The roof sheathing consists of two layers of ⅞-in. matched and dressed boards placed transversely and separated by 2 x 2-in. strips extending across the arch, the air space thus formed serving for heat insulation and preventing the condensation of moisture on the inner side. A layer of building paper is laid upon the inner sheathing, and over the outer sheathing is placed a felt and pitch roofing. Across one end of the building is a balcony carried by wood joists seated in the end wall and in stirrups on hanger rods whose upper ends are embedded in the 65-ft. arch rib.

Concrete Arches of 103½-Ft. Span Carry Roof of Garage

For each rib the form was supported on a timber frame or falsework, having bents spaced 10 ft. c. to c. The roof joists or rafters were seated in notches in the sides of the form, and at the middle of the span the first layer of roof sheathing was laid on the joists to serve as a platform for the concreting wheelbarrows. Planed 2-in. lumber was used for the forms, which were made watertight. This falsework construction was adopted partly because the work was done during the winter, as it permitted the entire area to be covered before concreting was commenced.

A rich and rather dry concrete mix of 1:1:2 was usel, with ¾-in. stone as the coarse aggregate. This was partly for strength and partly in view of the cold weather. No salt was used, but the water and materials were heated and salamanders were kept burning on the floor. Two of the ribs were poured on a cold day and zero temperature was reached the same night, but the concrete was not affected. Forms were left in place for 60 days. A Jaeger mixer at one end of the building discharged the concrete into whelbarrows which were hoisted to the roof platform and dumped into the forms, filling the ends first and then working toward the crown. The concrete was well rodded to ensure density and close contact with the reinforcing steel.

A snow load of 25 lb. per square foot was the live load element in the design. Compression in the concrete is taken at 750 lbs. per square inch. Owing to the high cost of lumber the cost of nine arches was only about $800 more than that of wood lattice trusses such as are used frequently in buildings of this kind, but the trusses would have formed considerable obstruction to proper distribution of light.

The arch ribs figupred first for the full dead load and for the live load over the entire span, which condition of loading determined the greatest horizontal thrust. The greatest bending moment in the arch was assumed to occur when the live load is acting on one-half of the arch. This moment is positive in the loaded quarted point and negative in the unloaded quarter point. Combining this bending moment with the thrust from the total dead load and the live load on one-half of the span determined the critical or most dangerous section of the arch.

One of these arches was tested at the demand of the Chicago Building Department, being subjected to a test load of 12,000 lbs. concentrated at one quarter point of the span. This test was made with a platform 8 x 10 ft. hung from the arch by three sets of ⅝-in. cables and loaded with 125 bags of cement, as shown in Fig. 4. Assuming the arch to act as hinged at the two abutments the greatest deflection occurs at the loaded point. According to the elastic theory the quarter point of the unloaded side should have a rise equal to the downward deflection of the loaded point, while the crown of the arch should not show any vertical deflection. Assuming a modulus of elacticity of 3,000,000 the formula gives a deflection of ⅝-in.

In the test, the deflection immediately after the load was applied amounted to ¼-in, at the loaded point and zero at the crown, with $\frac{3}{16}$-in. rise at the quarter point of the unloaded side. These values increased to ⅜-in. and ¼-in. at the quarter points after 24 hours, the crown still showing no deflection. Immediately after removing the loads the nonelastic deflection was ⅛-in, and $\frac{1}{16}$-in. at the loaded and unloaded points, respectively.

The architect and superintendent for this building was I. S. Stern, Chicago. The concrete arches were designed and constructed by L. J. Mensch, Chicago.

Quick Hardening Cement

We are drilling a well for oil here with a diamond drill and at present are down 1,270 feet. We run into a cavey formation a few feet thick that it was necessary to cement off. The time lost while this cement is setting is not only expensive but aggravating as well. We have been searching for relief from this situation as we are very liable to have more of this cementing to do before we complete the job.

We note in your magazine for February an article "Effect of Cal in Portland Cement." This is along the lines of information we are trying to get namely, accelerating the hardening of the cement.

For your better understanding of the matter will say that our hole is about three inches in diameter. There is water in the hole at all times so it is a case of pouring the cement down and tamping it with the machine and then let it set until hardened.

Now for your advice in the matter. The article mentioned above does not refer to the setting of cement under water. Would the acceleration be the same there as where exposed to the air? Also what percentage of Cal would you suggest be used?

This and any other information you may offer that will assist us in any way will be greatly appreciated by Businessmens Development Co., by E. C. Burlingame, Mgr., Walla Walla, Wash.

Practical Concrete Roofing Tile

Cement roofing tile are not used half as much as they would be if their protective value, durability, and economy were better understood. The difficulty heretofore seems to have been to get a tile at reasonable cost that would "stand the racket" and still give good service under exposure to severe weather conditions such as sometimes prevail in this country.

L. Hansan Co., 3617 East 23rd St., Kansas City, Mo., are manufacturing a Roofing Tile Machine that seems to solve this problem satisfactorily as judged by the lasting qualities, strength, and cheapness of the tile produced. That very attractive effects are possible with this type of roof covering, is demonstrated by the tile-covered buildings shown in their catalog and that the claims of the manufacturers are fully sustained by the quality of their work, is shown by the fact that they have built up a large business, not only in the line of their machinery, but also in the manufacture and sale of the cement products made on these machines and in the actual construction of hundreds of residences, factories, and other buildings in various parts of the country. Their machines make tile of various shapes in both the French style and also S-shaped Spanish tile, 9x15 inch in size.

Disc Crusher

The "100 a Year Club" book of suggestions, a very novel imitation of a 2-in. thick volume, published by Chalmers & Williams, Inc., Chicago Heights, Ill., is just off the press. This catalog explains the many advantages of the disc crusher, giving its dimensions, sizes and its various uses.

A New Crawling Tread Crane

One of the latest and most modern designs of crawling tread cranes developed is the new OS Dependable manufactured and sold by the Orton & Steinbrenner Co. of Chicago and Huntington. The same standards and specifications as regards quality of material and workmanship under which the larger types of locomotive rail cranes are fabricated, are embodied in this crawling tread machine. In fact the superstructure of it is proportionately identical with that used by the Orten & Steinbrenner Co. in their heavier and larger capacity standard gauge rail types. Two sizes of cranes are made in the new design both being especially adapted to contractor's use; they are rated as 7 tons nd 12 tons capacity.

The seven ton size is widely used by contractors for excavating and road work and also in coal, sand and gravel yards. When equipped with the OS Dependable ¾ cu. yd. clam shell bucket which it will handle with ease in any material at 30 foot radius, a more efficient single piece of equipment is yet to be made available for this class of service. Economically it stands supreme in its field. The cost of operation is astonishingly low. It is entirely constructed on the interchangeable duplicate part system which makes re-

pairs immediately available, thus minimizing loss of time due to inevitable breakages or worn out parts. Because of this the continuity of service obtained from the crane is truly remarkable.

The details of construction are very simple and rugged. The crawling tread is developed from and an improved for mof that used on Government tanks during the European War. The tread links and sprockets are of cast steel of ample size and the chain idler rollers are bronze bushed with patented pressure system of lubrication. Each crawling tread is supported on bottom between drive sprocket and idler by four or more pairs of idler rollers. Each pair of idler rollers is carried in equalizing strut backed by heavy coil spring and when traveling over obstacles such as railroad tracks, ties, logs, etc. rollers will tilt as much as 6-inches from the horizontal. This device equalizes pressure of crane on ground and enables it to travel over the roughest surfaces while yet maintaining constant compression on springs. It will travel up grades of 20 to 30 per cent in soft material.

Tread links are reversible and crane can travel with equal facility either forward or backward. Links are so designed that ends overlap and no foreign material can enter the spaces between, thereby eliminating the principal difficulty experienced heretofore in machines of this type. Crawling tread is adjustable by screw takeup and by single pair of idler rollers with coiled steel springs on top. The flexibility obtained by this arrangement is readily perceived. Surface area of crawling tread is great enough to reduce unit pressure on ground to 10 pounds per square inch less than produced by a 200 pound man, although crane weighs in the neighborhood of 45,000 pounds. Write Orton & Steinbrenner Co., 608 S. Dearborn St., Chicago, today for booklet giving a full description of the above cranes.

Hardsog Hammer Drill No. 3

By W. S. Miller

The No. 3 drill manufactured by Hardsog Wonder Drill Co., Ottumwa, Iowa, uses equipment similar to other machines, and should be fitted with ¾-inch hose, with air pressures 65 to 75 pounds at the drill. Under such pressure the drill is easily held and it does remarkably rapid work. High pressure makes any drill "kick," and while it is almost impossible to obtain competent help to submit to such conditions it is equally detrimental because of excessive wear and tear to any machine. It pays to save money at the compressor end as well as at the drill end of the air line by using a moderate pressure only.

Made of the best material obtainable and manufactured under the most approved methods, the No. 3 drill stands in a class by itself. It is a valve operated tool resembling in appearance the standard Hardsocq patterns, and is offered with an absolute guaranty to be equal to any similar competitive drill made. It must drill as rapidly, clean the drill hole as nicely, wear

as long, take as few repairs, hold as easily, and compare favorably with other drills to meet this guaranty.

The drill is made entirely of forged material, and all wearing parts are accurately machined, hardened, and ground. The steel used for each part is the finest that can be made for such service, and no expense is spared in building the best drill that can be produced.

This machine is fitted with live air valve, enabling the user to send a strong pressure of air direct from the air line through the drill steel, which is so necessary to clean deep holes or holes drilled in soft rock.

Then it has an air strainer directly connecting with the drill, which prevents small particles of hose lining, rock, metal or any foreign substance from entering the machine and causing an injury to closely-fitting, finely-finished parts, or the stoppage of the drill.

There is a good-sized lubricating chamber in the valve chest, and in addition to this, lubricant can be put into the strainer by removing the strainer plug. Those who wish to keep the drill from wearing and avoid drill repairs will use our Graphite Drill Lubri-

cant. A good grade of pneumatic tool oil will prove as serviceable in this as in any other drill made, but it is not so economical as our graphite lubricant.

The No. 3 drill weighs about 45 pounds, which is a desirable weight. It could have been built lighter, but it is more serviceable than a lighter drill; while on the other hand it is heavy enough for the greatest endurance without being over-weight and burdensome.

Drilling speed in limestone 6" to 18" per minute depending upon size hole drilled and nature of rock.

A Complete Pulverizing and Separating Unit, delivering a Uniformly Fine Product

The Hardinge Co., 120 Broadway, New York, have developed a new design of mill with large trunnions which has been highly satisfactory in operation. The new design mill is, in principle, the same as the type formerly manufactured, but embodies the experience in grinding materials by both the wet and the dry process. The bearings have been designed so that they may be watercooled, a very desirable feature when grinding hot clinker. These mills are grinding clinker so hot that water, poured on the shell boils.

The Titanite lining has been improved until now, in grinding limestone or clinker, these linings will last 4 or 5 years. as shown from the operation results under the most severe conditions.

A plate and screw type feeder has been developed which has given excellent results over wide ranges of capacity and character of material handled. It is possible to control the capacity of the mill instantly and very accurately.

For fine grinding, two distinct advantages have been made: One of the mills operating in conjunction with air separators, and the other with electrically vibrated screens. These systems have been proven beyond all doubt superior to the mills using single-pass and power-wasting methods.

Most Rugged and Best Dump Car

There is a vast difference between the dump cars built years ago and the product of today of the Continental Car Company of America, Inc., manufacturers of the "Continental" dump cars, Louisville, Ky.

Their present car is frequently referred to among contractors, pit and quarry owners and other users of this class of equipment as the "Efficient Dump Car," the car that will stand up under the work no matter what the conditions. It surely is a relief to a user of dump cars to know that he has a plant which he is sure will not cause him trouble and which will or is bringing in profits.

While it is true that their present car is more costly than the old type, it must be remembered that this company has expended a large sum of money to build the most rugged and best dump car and the improvements which have been incorporated in their cars have necessarily increased the cost of building them. It will be remembered, however, that the additional price paid by purchasers for a good car is more than offset by the additional efficiency and the smaller repair bills, which means more efficiency, and in the end more profits.

The general design of the present "Continental" dump car is the same as years ago, with but few changes. The improvements, however, consist of better and stronger materials and the strengthening of members of the cars that have shown tendencies to weaken under abnormal strains. The woodwork used throughout is of the best quality Southern Indiana White Oak. The wheels have proved to be exceptionally strong and in the 22 years that they have been manufacturing dump cars, the company claims that less than 5% of the wheels have worn out. The 125 four yard "Continental" dump cars owned by the Pinkerton Construction Company have handled over three and one-half million yards of rock and earth, which means that each car has handled twenty-eight thousand yards and that each car has dumped and righted seven thousand times.

The present product of the company is a great improvement over the cars above referred to and they should beat the record of the older cars.

The patent and bracing and door arm arrangements give the ends of the cars exceptional strength in resisting loads from pushing the ends out which permits a large door displacement when the car is dumped. It is claimed that no other dump car on the market has as large a door opening.

The dumping angle is 48 degrees. Write for new catalog.

Know Your Sand

The Universal Sand Tester manufactured by Kolesch & Company, 138 Fulton St. New York, N. Y. is a simple device giving promptly the information you want—in the laboratory, at the pit, in the plant or out on the job. You can produce stronger concrete at lower cost, if you know your sand. This is true

whether you are producing concrete bricks or reinforced concrete skyscrapers.

The strength of your concrete—the amount of cement required to make it meet specifications—these facts are easily and quickly ascertained if you know the character of your sand. To know it, test it. Kolesch & Co., will send you a booklet, without obligation, describing the scientific instrument that can be used by anyone—a device that will save you money. It costs nothing to find out about it.

News of the Cement Mills

Official announcement has been made by the Marquette Cement Manufacturing Co., whose plant is located at Oglesby, Ill., of a reduction in the price of cement. The cut is 25 cents a barrel.

The Napa Junction, California, plant of the Pacific Portland cement company is being dismantled. All machinery and equipment that can be used will be taken to Santa Cruz. This action results, it is claimed, from the company being unable to purchase at the figure it desired land adjoining the present site. The eighty-acre plot, owned by the company, and which yielded the material used in the plant, has been practically exhausted.

Finland has two cement works. Owing to recent extensions, they will this year be able to fill not only the whole of the home demand, but will also have a surplus to place abroad. Last year the output amounted to about 400,000 barrels of 180 kilos gross weight. The result was that imports of this article greatly decreased. In 1918, 26,485 tons of cement were imported; in 1919, 10,286 tons, and in 1920, 12,051 tons. In 10 months of 1921 the imports were not more than 3,711 tons, equivalent to about 20,000 barrels. At the same time, owing to the advantageous rates of exchange obtainable, a similar quantity was exported, chiefly to Sweden. The output this coming year is estimated at about 1,000,000 barrels, so that considerable export will be possible.

Production will be protected by a duty of not more than 3 marks per 100 kilos. The price is dependent on the price of coal, which has to be imported, but, as this is not more than one-fifth of the value of the cement, and about one-half the coal price is due to freight charges, which are earned either by the cement works' own ships or other Finish vessels, the amount of currency exported for the purchase of the coals is only about one-tenth of the price of the cement. Should conditions in the markets of the world allow of exports taking place ,the importance of this industry as regards the trade balance may be plainly seen.

The Petoskey Portland Cement Company, at its special meeting held recently increased the stock of the company from $1,250,000 to $2,500,000, of which $500,000 will be issued the remainder to stay in the treasury of the company. The new issue will be offered for sale to present stockholders and will be sold at par. The funds so raised will be used for the erection of a large raw material stock building at the west end of the present plant.

O. E. Wasson, formerly general superintendent of the Knickerbocker Cement Co., Hudson, N. Y., has accepted a position with the Crescent Portland Cement Co., Wampum, Pa.

The Glens Falls Portland Cement Co., Glens Falls, New York, has effected a 15 per cent reduction in wages at their plant. In addition to the reduction, the working day of the yard men and shop employes will be cut from 10 to 9 hours. Even with this reduction, however, the scale of wages will be higher than that generally prevailing in the cement industry.

The Southern Pacific Company has been authorized by the Railroad Commission to publish a reduction of 20 cents per ton on cement, carloads, from the cement producing points of Davenport, Chittenden, San Juan, Cement, Napa Junction and Tolenas to Livermore, Lyoth and intermediate points in California. Similar reductions have been authorized from Cowell in connection with the Atchison, Topeka & Santa Fe and Western Pacific railroads, to include Sunol and Pleasanton.

The Monolith Portland Cement Co., Los Angeles, Calif., reports continued improvements in the volume of sales of elastic waterproof cement. It is used very extensively for outside plastering on account of its easy working qualities under the trowel, and also owing to the fact that it produces a waterproof wall. However, the uses of this product are growing constantly for foundation work, sidewalks, driveways, reservoirs, floors, swimming pools and, in fact, all kinds of construction work where formerly an ordinary Portland cement was used.

Recent tests have shown this product has unique and unusual qualities. For instance, its adhesion to steel reinforcing is 50 per cent greater than ordinary Portland cement. In addition to this it protects the reinforcement from rust and deterioration.

Microscopic examinations also show that the crystalization of the concrete is very different than that of the ordinary Portland cement in that it produces a concrete which is very fine grained and where the crystals form in such a way that the concrete itself is waterproof.

It is also found that it is practically impossible to extract by any chemical process the materials which are interground into the cement for waterproofing owing to the fact that they become a part of the crystal of the concrete.

Architects and engineers throughout the west have welcomed this product as it enables them to do particular work in concrete which has heretofore been a serious problem in architecture and engineering.

The sales o fthe Monolith company have increased at such a rate that they are finding it necessary to double the capacity of their large plant at Monolith.

One of the interesting features of the new plant which the Pyramid Portland Cement Co., Des Moines, Iowa, are now building is the kiln construction. These kilns are 10 ft. in diameter by 240 feet long and the weight of a kiln is approximately 675,000 pounds. The extreme length is designed to give efficient and economical results.

Glen Falls Portland Cement Co., Glen Falls, N. Y., is enlarging its capacity by installing more kilns, waste heat boilers, erecting a reinforced concrete building for the storage of stone and clinker, and by installing a new system for cooling clinker and also a new crushing plant. F. L. Smidth & Co., New York, are in charge of the work.

Quarries *are* getting 1/3 more per dollar

We tried out Dumorite recently in our quarry at Staunton, Va., and I believe that on a stick basis it equals 40% Straight Dynamite. Besides being thoroughly satisfactory regarding strength, its non-headache and non-freezing qualities are very appealing to the quarrymen. I believe this the most economical and most satisfactory 40% dynamite made.

The excerpt above is from a letter written by a large user of Dumorite for quarry operation.

THE above is just one of many letters we have received testifying to the efficiency and economy of Dumorite for quarry work.

We believe that it will save *you* money, too. There is just one way to prove it. Try it yourself.

Dumorite gives you 135 to 140 sticks at the same price as 100 sticks of 40% dynamite. Stick for stick it will do approximately the same work.

Address our nearest branch office for full information.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

Branch Offices:

Birmingham . Ala.
Boston . . Mass.
Buffalo . . N. Y.
Chicago . . Ill.
Denver . . Colo.
Duluth . . Minn.
Huntington, W. Va.
Kansas City . Mo.
New York . N. Y.
Pittsburgh . Pa.
Portland . . Ore.
St. Louis . . Mo.
Springfield . . Ill.
San Francisco, Calif.
Scranton . . Pa.
Seattle . . Wash.
Spokane . Wash.

Du Pont Products Exhibit
Atlantic City, N. J.

NON-HEADACHE DU PONT NON-FREEZING

DUMORITE

THE LATEST OF A COMPLETE LINE OF DU PONT EXPLOSIVES

News of the Concrete Products Factories

The third annual convention of the Iowa Concrete Products association was held last month in Des Moines.

Five hundred manufacturers from all parts of the state attended.

C. H. Barnes of Red Oak, president of the association, made a vigorous attack on freight rates in Iowa and elsewhere.

"The cost of freight is now three times the cost of the raw material," he asserts.

Waterloo Concrete Corporation, Waterloo, Ia., has been organized as a successor to the Waterloo-Playford Silo company, at the same time increasing the capital stock from $20,000 to $100,000.

Greatly enlarged activities both in line of products and territory is planned by the new corporation. The old plant was confined to manufacture of stave silos, corncribs and grain bins. Adding work in concrete and "granette," the new firm will manufacture coal pockets, fence posts, monuments, building trimmings and lawn furniture.

"Granette" is a new product made of granite chips from New England quarries mixed with cement. The result is an artificial stone of the texture, polish and enduring qualities of the finest granite. It is used for monuments, building trimmings and ornamental purposes. It has enjoyed a very gratifying sale for the past several months, the makers say.

W. B. Trost, president of the new corporation, has been at the head of the Waterloo-Playford Silo company for the past six years. The concern has been in Waterloo for 11 years past, being originally known as the Waterloo Cement Silo company. Mr. Trost is vice president of the National Concrete Stave Silo association.

Associated with him in the new venture is C. L. Douthett as vice president and O. S. Ruggles as treasurer. Mr. Douthett was for several years past Iowa field representative of the Universal Portland Cement company, with headquarters in Waterloo. Mr. Ruggles has been salesman for the local silo company for the past five years.

The Concrete Lumber Co., 612 Black Bldg. Los Angeles, Calif., E. J. Pennypacker, Pres., Geo. A. Mesick, Secy.-Treas., Henry W. Schlueter, engineer and patentee, has been organized as a voluntary trust, with a capital of $1,000,000 . The company have purchased four acres of San Fernando Boulevard near Verdugo road, where they are erecting a factory for the manufacture of their product a concrete lumber which will be made from one to eight and a half feet long, and from six to 24 inches wide, with studding at the edges 3¾ by 2 inches; molded with groove and tongue, through which they are built up with steel shackles, making an antifriction joint. It is declared that this lumber, taking the place of wood in the pouring forms for heavy Class A buildings, both for walls, and columns by forming part of the completed structure will eliminate entirely the cost of the lumber that now is wasted, and reduce the cost of this form of concrete construction by at least one-third.

S. D. Clinton, formerly of Seattle has accepted the position as manager of the La Grande Concrete Pipe company, whose plant is located at Island City, Oregon. Mr. Clinton is a civil engineer of from 16 to 18 years' experience and in placing him in this position his company believes that the service to farmers and others can be greatly improved, a practical knowledge of engineering problems being of much help in marketing the company's varied line of products.

The company will continue to manufacture concrete pipe, silo blocks and septic tanks and the many other concrete products it has placed on the Eastern Oregon market during the past year. The company has recently secured a number of contracts from the county and the state highway department.

The American Concrete Tie and Products Company, John T. Davis, vice-president, 301 Gaither Building, has been organized for the purpose of manufacturing concrete blocks, telegraph poles, railroad ties, etc. Mr. Davis states that it is the purpose of the company's officials to invest about $100,000 in a plant and machinery. The plant is expected to be in operation by spring.

According to W. J. Black, Sac City, Ia., who attended the annual meeting of the Cement Products company at Spencer, Ia., last month, the reports of the business transactions for the past 12 months show a profit. No dividends were declared, however, as it was decided by the directors to keep the surplus money for overhead expenses until the three plants of Lanesboro, Mason City and Sac City are operating to full capacity.

Ideal Concrete Machinery Co., 1338 Monmouth street, Cincinnati, O., manufactures molds for making concrete fence posts. Concrete is poured into the molds and spaded so as to exclude the air. The mold is then left for the concrete to set until posts can be removed and further cured. Forms are usually sold in a battery or set of six. With the forms are included stands and staple benders. Staples are imbedded in the poses when the posts are poured. Forms are furnished in either 7 or 7½ ft. lengths. Posts are triangular in cross section and are larger at the bottom than at the top. Further details may be obtained by writing to the manufacurer.

The automatic Sealing Vault Co., 216 East River street, Peru, Ind., have a proposition to unfold to responsible concerns which offers unparalleled opportunities in field of business and margin of profit. If you are interested in starting a side line that will some day prove more profitable than your entire present business write them regarding their 1922 concrete burial vault proposition.

The Petrous Mfg. Co., D. G. Zeigler, Pres., Columbia, S. C., is building a new factory at Chuluota, Fla. which will be fitted with new machinery to make 45,000 bricks per day and other concrete products, including building wall tile, roofing tile, and sewer pipe. They will operate a Helm brick machine and a Kent continuous mixer.

Five Essentials For Hose Economy

To give consistent economy air drill hose must possess in highest quality five fundamentals.

[1] It must have a cover so tough, so durable and so wear-defying that it can be yanked and dragged about without rapidly being gouged and torn to pieces by rock. Wire winding should be unnecessary.

[2] It must be so flexible and well knit in construction that a sudden fall of rock will not injure it.

[3] It must have an oil-proof inner tube else the fine film of oil from the compressor will rot the rubber which the air will pick up and carry in loose particles to the chambers of the drill often to put it out of business.

[4] It must be kink-proof.

[5] It must possess such balanced qualities from tube to cover that it will not crack or kink back of the drill connection.

All of these fundamentals Goodrich Air Drill Hose has in the highest quality. That is why for uniform service and consistent economy it has never been surpassed. For economy's sake, use it!

THE B. F. GOODRICH RUBBER COMPANY, *Akron, Ohio*

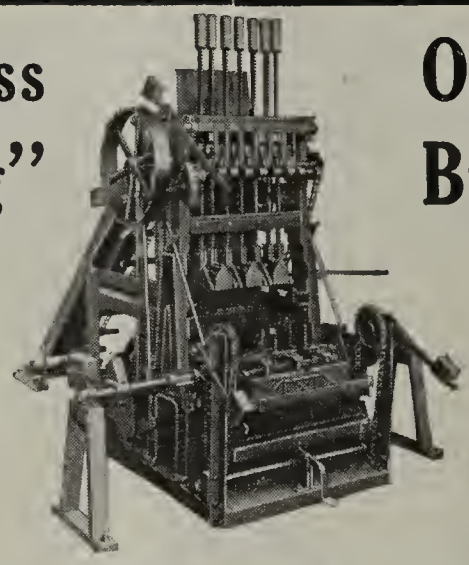
Goodrich

AIR DRILL HOSE

"20 Years of Success and Still Going Strong"

The advantage of more than a score of years' manufacturing experience is yours when you purchase any product bearing the Ideal name. But that isn't all! In every device of ours is bound up the integrity, the conscientious service and the liberal guarantee of a company whose chief aim is to make dependable machinery. That's why it is safe to stick to IDEAL, "all that the name implies."

Ideal



Our Fully-Automatic Building Tile Machine

represents the latest and best thought of our engineers, embodying the most advanced principles of time- and labor-conservation. Delivers three tile on a single pallet, with no stopping or delay for off-bearing of tile.

Write for Catalog

The Ideal Concrete Machinery Co.

1338 MONMOUTH ST. CINCINNATI, O.

A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.

One Block Soaks Up Water The Other Sheds It Off

Medusa Waterproofing makes the big difference!

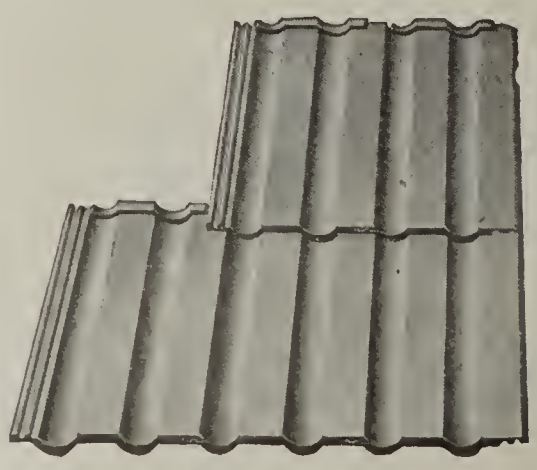
These two concrete blocks were pulled from the day's run at the same plant. Both were drenched with equal quantities of water, and these photographs taken immediately.

Make this test for yourself. We'll gladly send you, on request, free samples of Medusa Waterproofing with exact directions for using it, and the name of nearest "Medusa" dealer.

THE SANDUSKY CEMENT COMPANY
Department E, Cleveland, Ohio

MEDUSA
WATERPROOFING
for CONCRETE

THE U. S. CHAMPION CONCRETE TILES



FRENCH TILE

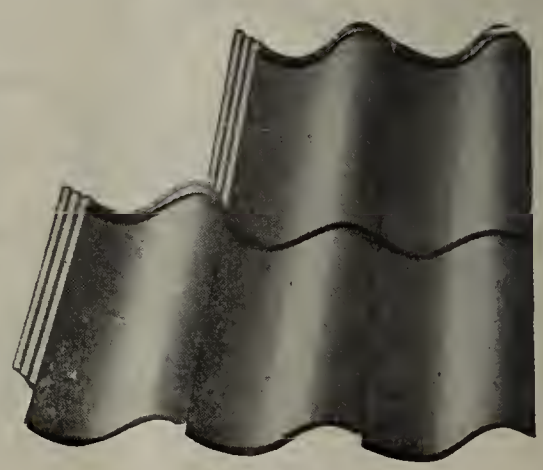
An Inexpensive Roofing Material. They are Handsome, Permanent and extensively Popular all over the world, made in two different styles and in desirable colors to meet any architectural requirement.

Although moderately priced, our tile outfit is the most serviceable on the market—turning out complete series of plain and odd tiles for even the most complicated roof.

Our tile outfit is made for YOU. Its name: "The U. S. Champion" and the rigid tests it has stood successfully through nearly 30 years of practical service is your guarantee. The business you can create for yourself with it is unlimited.

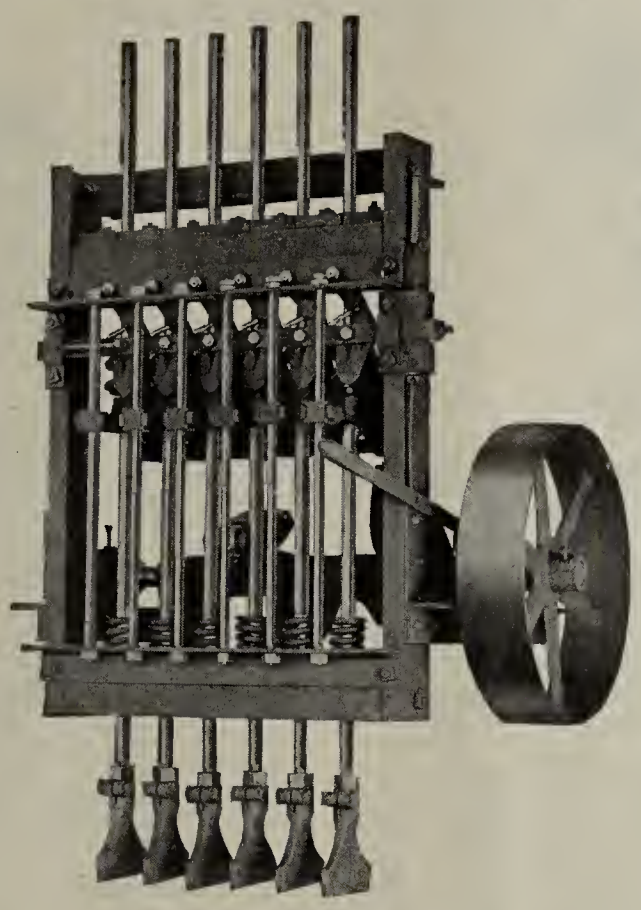
Write for our illustrated Roofing Book and Prices.

L. HANSEN CO.
3617 E. 23rd Street Kansas City, Mo.



SPANISH TILE

THE KENT RELIABLE TAMPER



A PROVED TAMPER

Kent tampers have many times demonstrated their ability to build good will among their owners. Dramatic tests and every day grind of ordinary service furnish abundant proof of the unfailing energy of Kent tampers, and explains the enthusiastic support accorded them among concrete block, tile and brick manufacturers.

Satisfied owners is our slogan. We can satisfy you that the Kent tamper is thoroughly reliable, sturdy, compact and powerful. It is built for service and built to last. The price will interest you—due to our special facilities and unusual manufacturing advantages.

KENT JR. BATCH MIXER

A one-bag size mixer, having a capacity of from 6 to 8½ cu. yds., of loose material, depending upon the size of aggregates used. It has a very substantial truck and frame designed to stand not only the use which a concrete mixer receives, but also abuse.

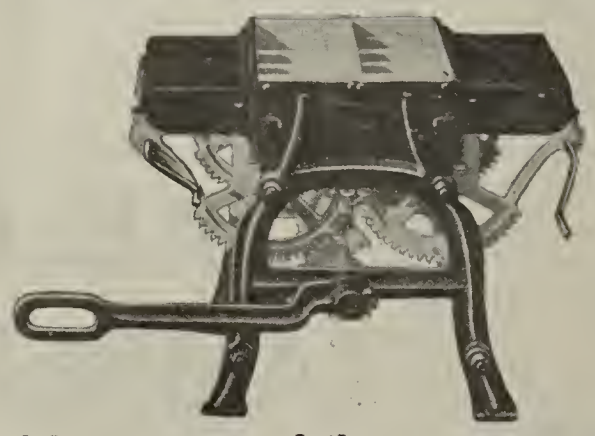
RED LINE PRODUCTS

Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

KENT, OHIO

CHICAGO OFFICE, 429 Monadnock Block



Double your daily output with

DOUBLE-SPEED

Brick and Block Machines

Now is the time to increase the capacity of your block plant—turn out the maximum number of wall feet per day, while the demand for building materials is at its highest.

Block Output

Our Double-Speed Block Machine makes in each operation: 2 hollow blocks, 2 silo blocks, 2 solid blocks, 2 slabs, 4 half blocks, 2 water table slabs, 2 return ends, 2 chimney blocks, or 2 porch pier blocks.

Brick Output

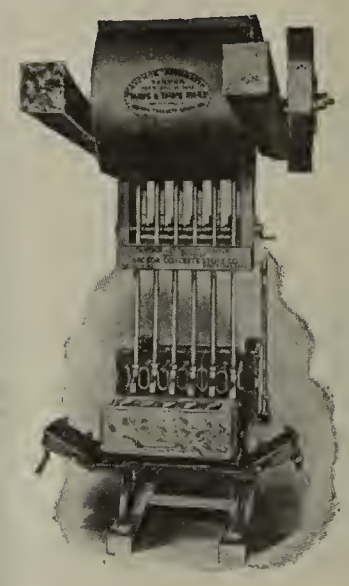
Double-Speed Brick Machine makes 16 brick at each operation, 8 brick being delivered at each side of the machine.

Double Speed Tamper

This power tamper gives our block machine a capacity of 1,500 blocks per day and speeds the brick machine up to 12,000 brick per day. Roller-cut-off removes surplus material from mold box and finishes the top of the product. The block and brick are tamped rapidly and vigorously, resulting in a dense, strong product. Machine consumes little power and is practically fool-proof.

Write for block and brick machinery catalog, Dept. A,

Wood Bros. Thresher Co. Des Moines, Ia.



THE HOBBS

The multiple oval cores of a Hobbs machine make the use of wet mix possible with no loss of time. The result is a hard, dense, waterproof block—plain for foundations and cover walls—faced for superstructure.

For Catalogs and Prices, write

The Anchor Concrete Machinery Co.

Adrian, Mich.

Rock Rapids, Iowa; Columbus, Ohio.

More Money for You in Vault Building!

—Use—

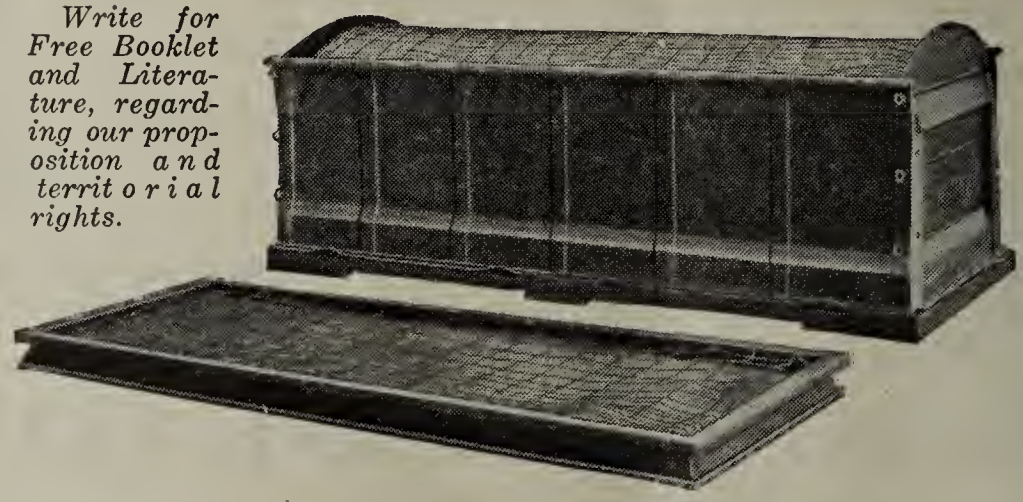
Doswell & Kover Forms

Manufacturers using our Forms can make more money building the famous Doswell & Kover, Automatic-Sealing, Cement-Reinforced and Water-Expelling Burial Vault, than is possible with any other form on the market.

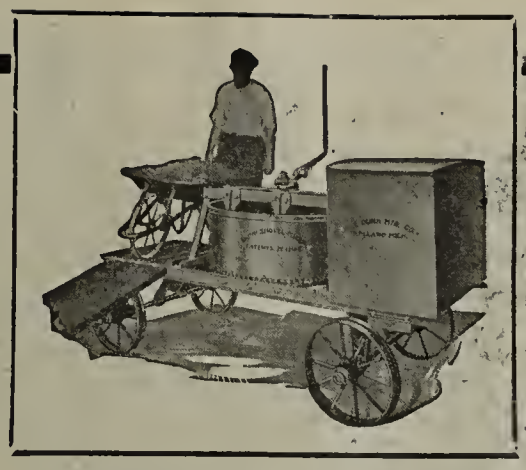
Start a business of your own. Small capital needed. Our patented Form is easy to set—Built right side up—Reinforcement easily placed and cement quickly poured.

We sell our Forms direct or Outright to you only.

Write for Free Booklet and Literature, regarding our proposition and territorial rights.



DOSWELL & KOVER, 1820 Richardson St., Fort Wayne, Ind.



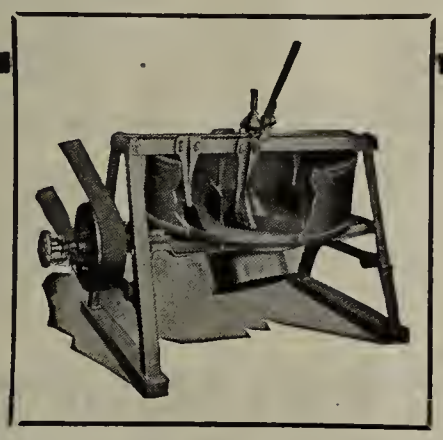
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



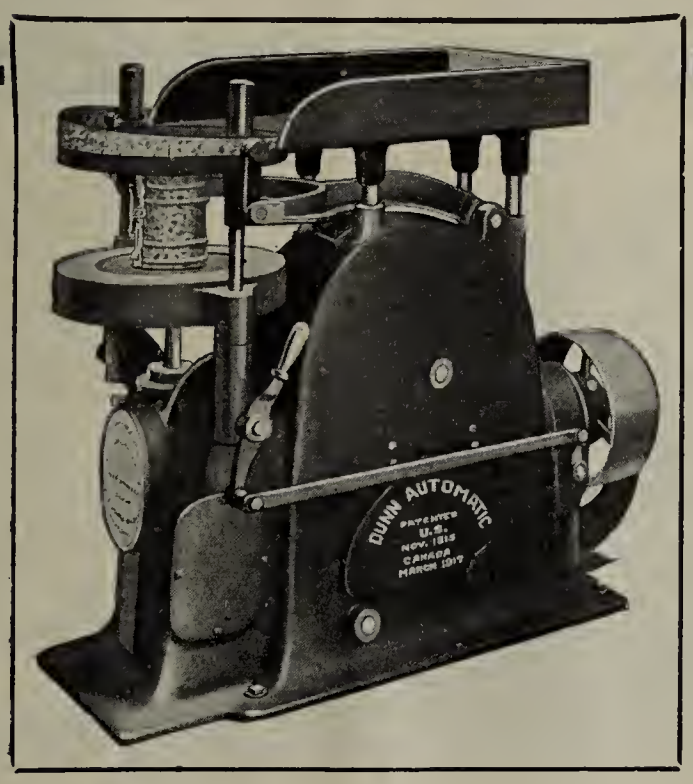
The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

414 W. 24th Street

HOLLAND, MICHIGAN

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

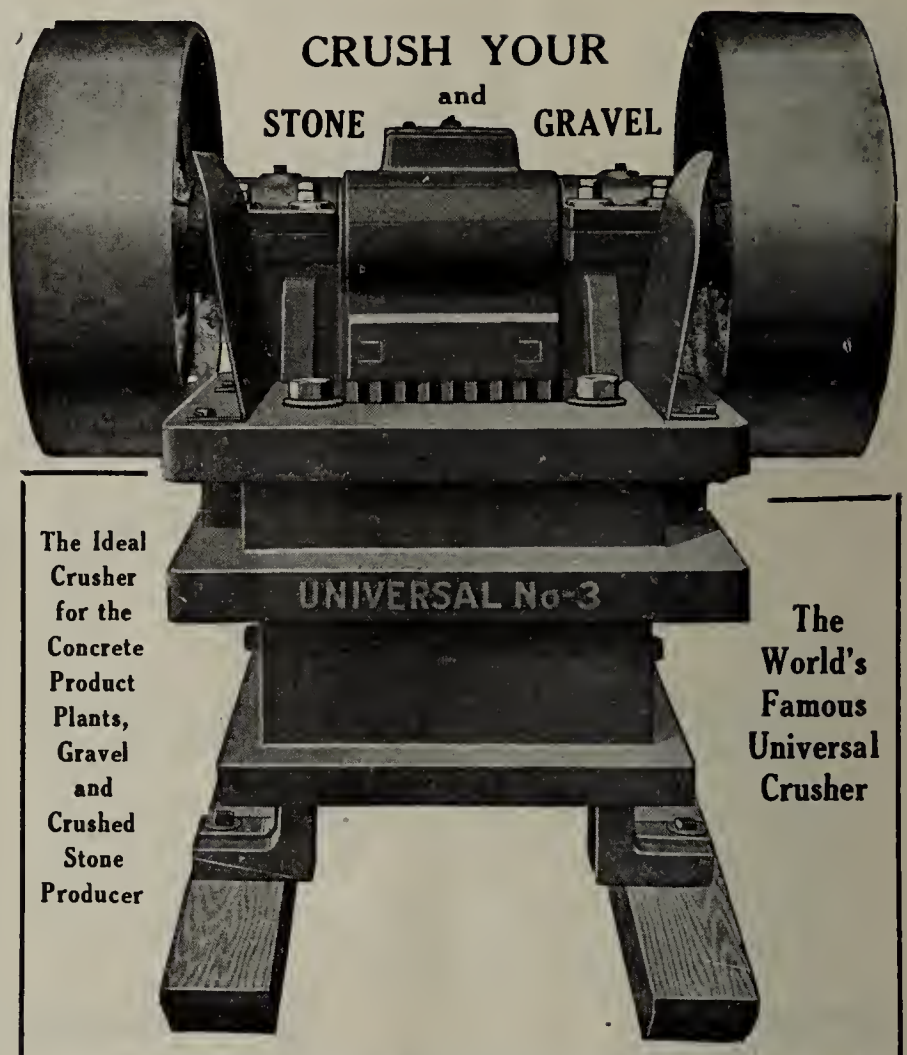
Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,

FASTEST ALLEY – STREET AND "ALL PURPOSE" MIXER BUILT

Get Our New Prices and Catalogs On Building and Paving Mixers (ALL SIZES) and Hoists

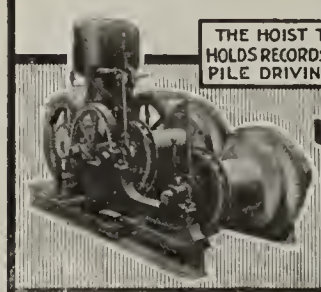
Write or Wire

The American Cement Machine Co. Inc.

Branch Offices in All Principal Cities

Keokuk Iowa
THE 300,000 HP. ELECTRIC CITY

Prompt Deliveries From Stocks in Principal Cities

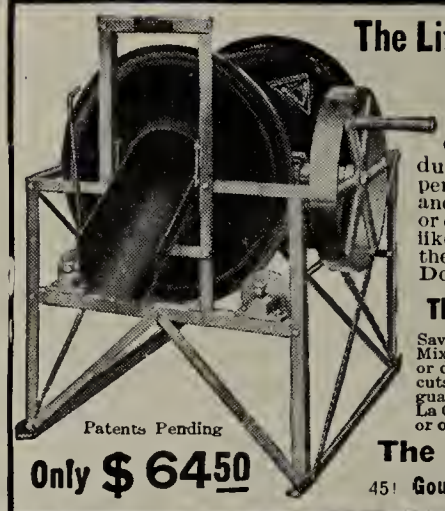


THE HOIST THAT HOLDS RECORDS FOR PILE DRIVING

MOST REASONABLY PRICED "ONE BAG" MIXER ON MARKET

Used By Over 6,000 CONTRACTORS

ONE MAN CAN RUN IT



The Little Whirlwind Concrete Mixer

THE MASTER MIXER

From Factory to You—Save 40%

Only ***real practical*** small mixer producing same ***perfect*** work as most expensive big machine. Complete with hand and power drive. A ***winner*** for the contractor or cement worker. ***All steel and iron.*** Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forms, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delays.

Patents Pending

Only $64.50

The Little Whirlwind Mixer Co.

451 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

SAVE CEMENT

Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

Write us for particulars.

Handy Sack Baler Co.

620 S. 2d St.,

Cedar Rapids, Iowa

Make More Money out of Concrete Work!

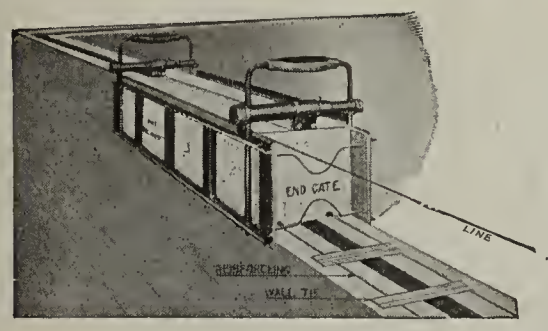
Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

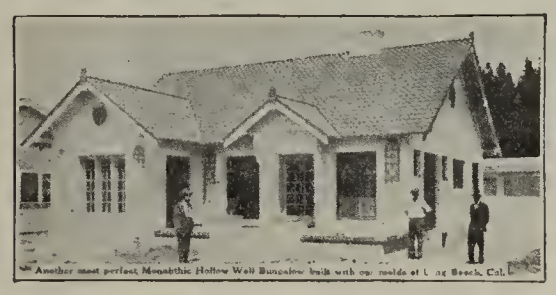
Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

For 50% **Build the Hollow Wall Way** For 50%





Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

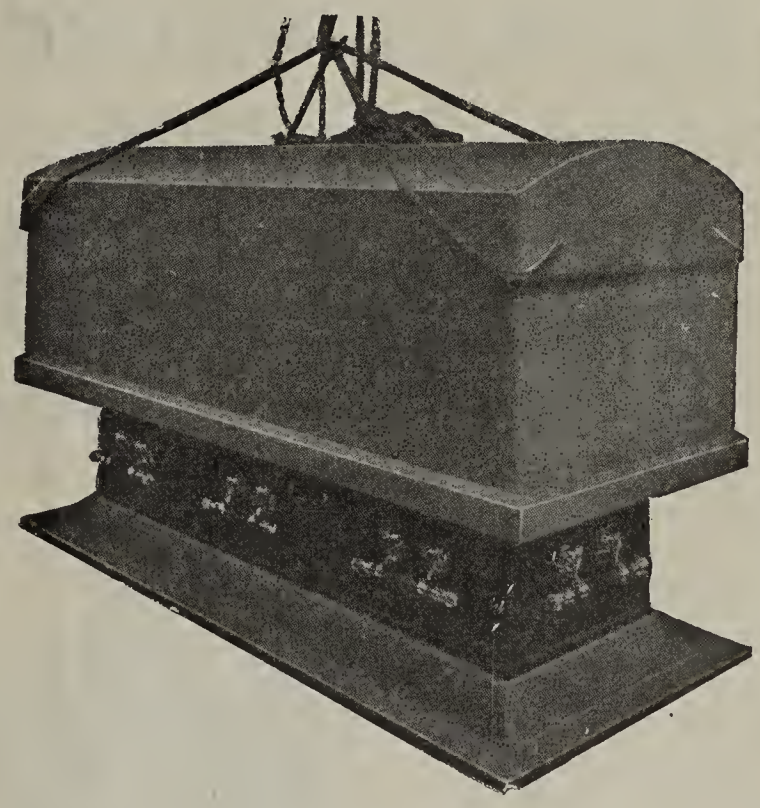
make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.



GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE"
(Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples
VICTOR BALATA & TEXTILE BELTING CO.
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston
CONVEYOR BELTS A SPECIALTY

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has been limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel bank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

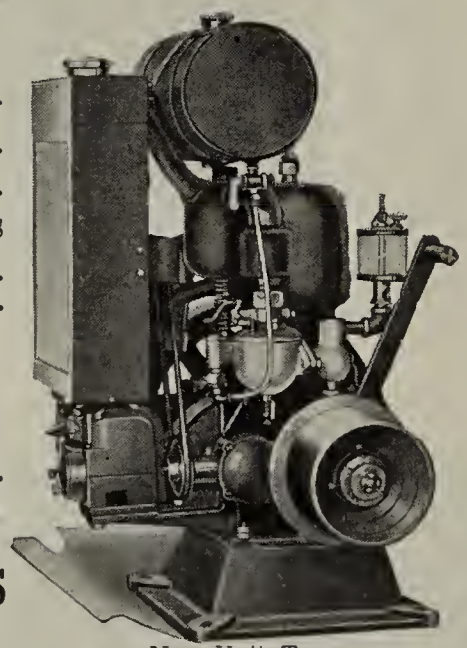
Sauerman Bros., 1139 Monadnock Bldg., Chicago

Your Machine Will Deliver Better Service With a

CUSHMAN

Light Weight Heavy Duty Engine

Over 50,000 in successful service. Sizes, 1½ to 20 H.P. Let our engineers work with you. Write us your power problem.



New Unit Type
4 H.P. CUSHMAN
Weight, complete, 230 lbs.

CUSHMAN MOTOR WORKS
821 N. 21st St.
Lincoln Neb.

NAYLOR *Lock-Seam* SPIRAL DREDGING PIPE

The greatest advance in the manufacture of spiral pipe. It is formed of one continuous strip of very tough Skelp Steel, and is made absolutely water and air tight without the aid of rivets or the use of pipe coating. Has double the life of any other.

If you are interested, we will be pleased to send you, at our expense, a small section of 12-inch, No. 10 gauge steel pipe; it will demonstrate to you the serviceability and economy of our Lock Seam construction.

ROBERTSON BROS. MFG. CO.
5401 So. Western Blvd. CHICAGO, ILL.

Cement and Engineering News

Vol. 34 Chicago, SEPTEMBER, 1922 No. 9

"A National Organization to Improve and Extend the Uses of Concrete"

At a certain quarry in southern California, at which crushed rock was being produced for concrete road construction, about 35 per cent of the crusher output had to be wasted to produce material complying with the specifications. The problem was put up to local representatives of the Portland Cement Association, with the result that certain changes in the screens were suggested by D. A. Abrams of the Structural Materials Research Laboratory, Chicago. An adjustment of the concrete proportions was also made, all of which reduced the quarry waste from 35 per cent to 15 per cent, and effected a total saving in quarry costs for the road mileage to be built of more than $22,000. This saving is being put into additional mileage.

This incident typifies the public service rendered by 85 manufacturers of portland cement through the Portland Cement Association. The caption above this editorial explains in a single phrase the purpose of the organization.

In 1902 several portland cement manufacturers met at a dinner in New York to discuss a common problem—empty sacks. With the change of the shipping container from the wooden barrel to the returnable cloth sack, came the difficulty of getting the sacks back to the mill which brand they bore. Out on the job, two or more brands of cement might be in use, and the builder seldom took the trouble to bundle separately the empty sacks of different brands. From serving as a clearing house for empty sacks, the meeting grew into a forum for the discussion of other common problems in cement manufacture.

The greatest problem was that of getting the public to use more cement. More mills were being built and operated than could find a market for all of their capacity to produce. Several small associations of cement manufacturers in various parts of the country had been organized and in 1904 these united to form the Association of American Portland Cement Manufacturers—the first really national organization. One of the great problems of that time was to conform to the many different specifications under which cement was to be made. Almost every construction engineer prepared his own specification, and the provisions which had to be met were as many and as varied as the names of the engineers. The Association named a Committee on Specifications to co-operate with the American Society for Testing Materials, the American Society of Civil Engineers, and the United States Government, toward much needed standardization of specifications.

In 1905 an office with a permanent secretary was opened in Philadelphia, and the organization grew slowly from 1905 to 1916. The beginning of the use of concrete for pavements about 1910 created a great opportunity for service. It was realized that the use of portland cement would increase only with popular understanding of its possibilities. Intelligent and purely commercial self-interest pointed to a policy of public education regarding the proper use of concrete as the surest means of extending the market for cement. There was much that was known about the fundamentals of good concrete, but there was still more unknown. Consequently the Association set to work to tell the public what was known about good concrete, to find out about those things which were unknown—and to tell the public of other facts as they became established.

The most important of several policies that guided the Association from the start was that of rigidly excluding from its activities any matters relating to the sale or distribution of portland cement. Association employes were told that their mission was to create an increased market for cement by helping the public to make good concrete by correct and economical methods; and to give assistance in the planning of concrete improvements so that such structures would best fulfill their intended purpose.

In 1916, the name of the organization was changed to Portland Cement Association. The general offices were moved from Philadelphia to Chicago, to secure the advantage of a central location for a truly national organization, and district offices were established in 12 cities, each in charge of an engineer skilled in concrete construction. Each of these district offices had a staff of field engineers who traveled in assigned territories calling on engineers, architects, contractors, or anyone who might be interested in concrete construction of any kind. These field engineers give direct assistance in design and construction problems involving concrete, and the field staff was supplemented by a staff of engineers in the general office at Chicago, prepared to render consulting service on matters which could not be handled directly by the men in the field or by the district offices. Provision for laboratory research work was made through the Structural Materials Research Laboratory of Lewis Institute, Chicago, which under the direction of Prof. Duff A. Abrams, had already become a leader in studies of concrete and concrete materials. A co-operative arrangement was effected with Lewis Institute whereby the administration of the laboratory was vested in a committee of two representatives of Lewis Institute, and two representatives of the Portland Cement Association. The space and equipment of the laboratory

were greatly enlarged, and funds provided for intensive study of concrete on a scale never before attempted.

Since 1916 the number of district offices has grown to twenty-four, one of which is located in Vancouver, British Columbia. Through its field staff, the general office, and the research laboratory, the Portland Cement Association has served as a clearing house for the best thought of the country's concrete engineers and builders.

The early difficulties about conflicting specifications for portland cement have been entirely cleared up through joint action of the manufacturers, the United States Government, and the great technical societies. Standard specifications were agreed upon, which are now recognized throughout the United States. By a fundamental amendment to its By-Laws, membership in the Portland Cement Association has been made contingent upon the members' product conforming to the standard specifications for Portland Cement adopted by the United States Government and the American Society for Testing Materials. Thus membership in the Portland Cement Association has become a badge of *quality,* and its value to the users of the product as well as to the members, has been greatly enhanced.

One of the ideas always kept before every Association representative is "Good concrete is our best advertisement." An owner who has a satisfactory concrete building, is an asset to the portland cement industry, because he is a satisfied customer. If concrete pavements being laid by a community for its streets or roads, shows when completed that they were well built, that community becomes a "booster" for concrete pavements. The truth of this is shown by the fact that in 1909 there were barely 1,000,000 square yards of concrete pavements in the entire country, while at the end of 1921 there were more than 262,000,000 square yards completed and in course of construction.

The Concrete Highway Magazine represents one of the methods used by the Association in spreading information about the design and construction of concrete pavements. It is mailed every month, without charge, to a list of more than forty-two thousand names. Other publications and special bulletins are issued frequently to provide up-to-date information about new uses of concrete, or improved methods of making concrete. If you can use concrete—this service is yours at request.

The Portland Cement Association—"A National Organization to *Improve* and *Extend* the Uses of Concrete" represents the co-operative effort of the portland cement industry to expand the markets for its product by intelligent and helpful public service.

Memory

No one will dispute that some few men are endowed by nature with splendid physiques and great bodily strength, while others are veritable weaklings. Likewise, it is impossible to deny that proper and vigorous exercise will greatly strengthen a frail body, while even a giant's strength is sapped by inactivity. The memory is just as much a part of the physical body as the muscles of the arms, but many are prone to disregard this fact. What its owner claims to be a weak memory is, in the majority of cases, a memory lacking only exercise for its development.

The use of engineer's guides, memorandum books, and such artificial memory aids tends to militate against the development of memory. Such tables of information are invaluable, beyond a doubt, but they should not usurp the proper function of the brain. The scientist and engineer must have a firm grasp of his knowledge, must have the fundamental facts in his mind ready for instant use, not stored in some book. The retort will be made, no doubt, that it takes too long to acquire thoroughly so much information. If such be the case, then obviously the faculty of memory stands only that much more in need of development.

The memory functions easily only when a person's mind is concentrated on the subject in hand, with all extraneous matter shut out. Concentration, in turn, is almost subconscious when one's interest is highly aroused. So in the last analysis memory depends directly on interest, or the will to make oneself interested in some specific question. If there is an earnest desire to find interest in a subject, it will be found; although it takes much impelling force of will.

Ability to remember and recognize acquaintances is a paramount part of any professional man's equipment. Concentration at the time of introduction to a stranger, repetition of his name whenever possible, and fixation of his features firmly in the memory, insure that the name will not slip from the mind when it is needed at some critical time.

There are a thousand and one little ways like these by which one can aid memory development. Though they take little time they do take conscious effort. But this effort is well worth while and everyone should take great pains to develop the memory for it is in reality the basis of all mental processes.

What Is Portland Cement?

From La Revue des Materiaux de Construction.

Scientists who have studied the subject appear to be divided into two groups, one of which declare that Portland cement is merely impure tricalcium silicate, while the other group maintains that it is a highly complex mixture of various silicates and aluminates. Those who regard it as an impure silicate have clearly overlooked the very considerable proportion of alumina which is always present, and yet to include this would at once destroy their theory. Those who regard cement as a complex mixture have derived their idea chiefiy from a study of the behavior on cooling of a number of pure oxides which have previously been heated to complete fusion, whereas Portland cement never reaches this stage, but is only heated to the sintering point. It is also a curious fact that when Portland cement of excellent quality is fused completely in an electric furnace, and is then allowed to cool slowly, it does not possess the special characteristics of cement clinker, but behaves as an entirely different material.

The fact is, there has been far too much guess-work and mere theorizing where there should have been a broad-minded examination of the whole of the known facts. For instance, it has not been definitely determined how far the constituents which first melt during the burning of the cement attack those which are more refractory, and it is assumed, rather than proved, that such attack and fusion proceed progressively. If the most fusible materials melt first, there ought to be visible under the microscope particles of fused material uniformly throughout the mass, whereas a microscopical examination of the smallest particles show that they are only fused superficially. This superficial

fusion may not be due to the presence of more readily fusible particles at all; it may be caused by the low thermal conductivity of the material which allows the exterior of a particle to fuse but does not permit the heat to penetrate into the interior sufficiently to raise the whole particle to fusion point. In fact, the phenomenon of fusion, which appears so simple to the uninitiated, is, in reality, so complex as to be almost impossible of exact observation when studied in connection with such substances as cement and clays. In metallurgy, the microscopical examination of polished and etched specimens often enables the crystalline structure of the metal to be recognized and its various constituents to be identified, but this method fails in the case of Portland cement because it demands a complete fusion of the mass—which does not occur —and the production of normal or nearly normal crystals, whereas in clinker the presence of the impurities and the absence of sufficient fusion prevents the proper formation of a crystalline structure and makes the identification of alite, belite, etc., wholly inconclusive, though these substances are recognizable in completely melted mixture of pure oxides with a composition resembling that of the cement.

Attempts at synthesis by means of pure materials have not led to any conclusive results, as such synthetic mixtures are always "poor" cements, the impurities present in the natural materials playing a far more important part in giving the cement its valuable properties than is commonly supposed. The addition of water to cement provides additional complications without removing any of the other difficulties experienced in endeavoring to ascertain its constitution, for water decomposes the cement, liberating free lime which reacts with the other constituents and sets up a fresh series of reactions. The substitution of other fluids has yet proved whether this substance exists.

Another impossible explanation is worth consideration; if the formation of cement is due to the presence of a catalyst which is included among the impurities, it ought to be possible either to isolate this or to substitute another catalyst for it and so facilitate the production of the cement and make the determination of its constitution much easier. The disvocery of such a catalyst might make the production of a pure cement possible.

Modern Concrete Proportioning

Members of the Halifax Branch of the Engineering Institute of Canada held a special meeting at the Nova Scotia Technical College recently, to listen to an address by Lt.-Col. H. C. Boyden on "Recent Developments in Concrete." Col. Boyden is a member of the engineering staff of the Portland Cement Association. His lecture summarized the results of investigations carried on under the direction of Prof. Duff Abrams of the Lewis Institute, Chicago, for that association.

Col. Boyden stated that the Portland Cement Association had reached the conclusion that concrete proportioning must be put on a more scientific basis in order that the resulting concrete should have a definite pre-determined strength. With this in view, Prof. Abrams had been selected by the association to take charge of laboratory investigations at the Lewis Institute. His instructions had not been very specific. He was simply to investigate concrete. He was not hampered by a time limit nor by lack of funds. His first report was not made until three years after beginning his investigations.

As a result of these investigations, said Col. Boyden, it was found that the older systems of concrete proportioning are inaccurate, and that instead of specifying a 1:2:4, 1:1½:3 or 1:2½:5 concrete, one should specify that at the end of 28 days the concrete should develop a strength of 2,000 or 3,000 lb. per square inch, or such strength as the work might require.

It was found that the water content is an important factor in concrete; a factor practically ignored by most specifications. In determining the proportions for a mix a factor known as the fineness modulus was computed from the sieve analysis of the aggregate. It was found that mixtures of fine and coarse aggregates having the same fineness modulus required the same amount of water to produce concrete of the same workability and give concrete of the same strength. The water is expressed as a function of the cement, a certain water-cement ratio giving a definite strength.

"Relative consistency" is measured by the slump test on a 12-in. cylinder of freshly mixed concrete. That quantity of mixing water that causes the cylinder to slump about one inch when the mould is withdrawn gives normal consistency, or relative consistency of 1.00. If a certain water-cement ratio produces a certain strength for a certain "relative consistency," and a wetter mixture is desired, the same strength to be produced, then more cement must be added to keep the wateh-cement-ratio the same as in the drier mix. Thus a wet mixture, such as that used when the concrete is distributed by chutes, requires more cement, which means more expensive concrete. In deciding, therefore, whether to deposit the concrete by chutes, the saving thereby effected must be balanced against the added cost of the extra cement.

Col. Boyden is of the opinion that the scientific methods being evolved at the Lewis Institute will eventually supplant the present methods of concrete proportioning. At the present time some architects and engineers are specifying that the concrete should be proportioned, not by arbitrary quantities, but in such a way that a certain strength be attained at 28 days. Experiments have shown that a certain predetermined strength can be easily obtained within 10%, especially after one becomes accustomed to the methods employed.

Following the lecture there was a very interesting discussion. Col. Boyden stated that tests have shown that the strength of concrete does not depend on the hardness of the coarse aggregate. Tests have also shown that many "hardeners" and waterproofing powders are of doubtful value. The addition of one-thousandth part (by weight) of tannic acid to clean sand has seriously weakened the resulting test specimen, thus showing the harmful effect of organic matter in sand, even when present in very small quantities.

Directory of Cement Mills

The American Cement Directory for 1922 is ready for distrubution. This authoritative compilation of the cement industry has recently come off the press in its usual neat and attractive form, published by the Bradley Pulverizer Co., Boston, Mass. It contains some 68 pages of lists of cement manufacturers, including the names of a dozen or more foreign companies.

Crushing and Screening Plant of the Birmingham Slag Co.

Prospects are fine and they are enjoying a good business, so declare the Birmingham Slag Co., whose crushing and screening plant is illustrated below. It has a daily capacity of 400 tons and was designed and equipped by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The slag plant is on the property of the Tennessee Coal, Iron and Railroad Co.

The Tennessee Coal, Iron and Railroad Co. operates six blast furnaces, which produce on an average 3,000 tons of slag per dag, seven days a week. It is poured in permanent troughs alongside the slag plant under the control or direction of the slag company. This permits scientific methods to be employed so as to obtain a slag of maximum density and deposited in a manner to permit of the greatest economy and efficiency in excavation.

The slag is excavated by 95-ton steam shovels equipped with special bucket teeth (long and sharp). These shovels load trains of six 12-yd. Continental side-dump cars. These trains use the permanent slag-pouring tracks, which belong to the steel company, and which are equipped with a third rail for electric motor operation. Six electric motor cars are required for the slag plant equipment.

Crushing Plant

The slag is dumped from the cars into a concrete hopper feeding a shaking grizzly. The material passing the grizzly by-passes the No. 8 gyratory crusher and is chuted to the loading hopper of the skip hoist. Everything that passes over the grizzly also goes over a magnetic roll which separates out the pieces of material composed wholly or largely of iron. The iron goes to a concrete pit alongside the crusher, from which it is loaded out by means of an electric crane and magnet.

The crusher is set in a concrete-lined pit and discharges to the receiving hopper of a balanced skip hoist. The skip cars are all steel, of 8 cu. yd. capacity, and operate on a 150-ft. incline to the top of the plant. The cars are filled and emptied automatically and are controlled by an electric hoist which also operates automatically.

The skips dump end-wise into a large bin, which is provided with two "sling feeders," or oscillating segmental gates. These feed the crushed slag automatically in a constant amount to two magnetic rolls, where all the small pieces of iron, which have been through the crusher, are removed and chuted to a concrete collecting bin for return to the steel plant.

Screening Plant

The crushed slag passing the rolls is fed to screens adjacent to them. These first screens are mounted on parallel shafts and each is driven by a direct-connected electric motor. The Foote speed reduction gears and the drive gears are completely enclosed in steel-box guards.

These screens are 26 ft. long and 5 ft. in diameter with ¾-in. perforated dust jackets on the upper halves. The screen plates are perforated to remove four sizes of material as follows: No. 1 (4 to 2½-in.); No. 2 (2½ to 1½-in.); No. 3 (1½ to ¾-in.); No. 5 (¾-in. to dust). The No. 5 (¾- in. to dust) material passes through two vertical chutes at the head of the screens to the floor below, where there are two smaller screens.

The lower screens are placed end to end (with the feeding spouts between) and are at right angles to the pair of large screens above. The two smaller screens which are 16 ft. long by 4 ft. in diameter are also driven by individual direct-connected electric motors.

The smaller screens separate the No. 5 material (¾-in. to dust) into three sizes as follows: No. 4 (¾ to ¼-in.); No. 6 (½ to ¼-in.); No. 7 (¼-in. to dust).

The screening plant is designed so that it can be operated for a maximum capacity of 2,000 tons per day by using only one large and one small screen, or for a maximum capacity of 4,000 tons per day by using both pairs of screens. The large screen rejections are returned to the crusher by a gravity chute.

Storage and Loading Facilities

The screened slag flows by gravity through chutes into concrete storage bins, which have a combined capacity of 1,500 tons. By shifting the chutes two or more sizes can be mixed and shipped on short notice.

Two loading tracks are provided under the slag bins (one is under the iron bin). The bins are emptied

Plant of the Birmingham Slag Co., Birmingham, Ala., one of the most up-to-date crushing and screening plants

through balanced segmental gates, 30x32-in., operated by levers from elevated platforms.

The cars as they are being loaded stand on 75-ft. track scales, which permits accurate loading to orders and saves much delay and annoyance in making shipments. This feature of the plant is considered one of its best, for much time and money was formerly lost in waiting for the railway company to take the cars to its scales, and then often times the slag company was compelled to remove 5 or 6 tons overload with the cars at some out-of-the-way place.

To further facilitate deliveries soon after the cars are loaded they are delivered by the slag company's own locomotives to any of the nine railway lines serving the Birmingham district.

Slag Reserve Supply

Although the crushing and screening plant is designed to handle the entire daily output of the blast

furnaces, it is not dependent on the operation of the furnaces for its supply of raw material. About a mile from the slag plant is a dump estimated to contain from 10,000,000 to 15,000,000 tons of old slag.

The slag company owns and operates a standard-gauge railway to this dump, which as the accompanying views show, closely resembles a quarry working. The face is 25 or 30 ft. or more high and is drilled with well drills and blasted as in any limestone quarry.

The Birmingham Slag Co. has had its product thoroughly tested as a concrete aggregate and has advertised its wares in thoroughly up-to-date fashion. Shipments are made to points in Mississippi, Alabama, Georgia, and Florida. A large part of the output is used in road and pavement work.

Batch Boxes Transferred from Trucks to Cars

By adopting a combination of motor truck and industrial railway haul, the contractor for a five-mile reinforced concrete road job in Bradford County, Pa., so arranged the work as to secure the maximum use of the completed pavement. This meant that periods of wet weather, which would have made the unimproved road impassable for trucks hauling dry batches, did not prevent the transportation of materials from the loading station by truck to the end of the concrete open to traffic, and from that point to the mixer by industrial railway.

The only railroad point available was at the northern end of the job. The mixer was started here and materials delivered by the industrial railway, which was placed along the shoulder. As soon as the first section of concrete had been cured sufficiently, four ton trucks, each carrying three steel, tipover, batch boxes, were put into service. Stone and sand for a four-sack batch were carried in each box and sacked cement hauled out to the transfer point in a separate truck.

The batch-box transfer consists of an I-beam mounted at each end on a wooden tripod, with sufficient distance between supports to provide clearance for two trains and a truck. By means of a chain block suspended from a four-wheel carriage, which runs on the lower flange of the I-beam, loaded boxes are picked up and placed on the cars, two to the car, except that one car of a train carries a single box. This makes it possible to transfer a loaded box to fill the empty space and then to move empty and loaded boxes alternately.

Three trains of six cars each and two 3-ton Plymouth gasoline locomotives make up the rolling stock. Five cars in each train carry a total of nine boxes, and the sixth car is for cement. One train is always loaded, another is being loaded, while the third is at the mixer or en route to or from the transfer point. At a signal given at the mixer, the loaded train leaves the transfer station and passes the returning empty train at a siding a few hundred feet from the mixer.

A derrick attached to the mixer frame dumps the boxes. Cement is added to the skip. The contractor is the B. G. Coon Construction Co., of Luzerne, Pa., and J. S. Ritchey is district engineer for the Pennsylvania State Highway Department.

Aggregates for Bradford County, Pa., concrete road work were carried by trucks, from a central proportioning plant, in tip-over boxes, to an industrial railway which delivered them to the mixer.

Fortieth Year of Smidth & Co.

Commemorating the 40th anniversary of the firm of F. L. Smidth & Co., an exceedingly interesting and attractive anniversary book has been published in the Danish language. This book which contains nearly 300 pages, traces the development of the cement industry along with the development of the Smidth organization. A large number of illustrations show pioneers in the industry and cement plants which have developed during the growth of the industry.

The founder of this organization, Verner Frederik Laessoe Smidth, was born in 1850 at Kerterminde on the island of Funen, the second largest island of Denmark. Mr. Smidth's father was mayor of the town in which he was born. The business was founded on January 2, 1882, as a technical bureau, handling principally the purchase and sale of second-hand engines, the erection of flour mill plants, and the planning of brick works. The flour mill industry declined and the brick work led the firm naturally to the installation of cement works. The first cement plant erected by the company was built at Linhamn in Sweden in 1888 and was soon followed by several Danish and other Scandinavian works. Between 1890 and 1895 branches of the organization were established at London, St. Petersburg and New York. During this time the tube mill was introduced.

Mr. Smidth died in 1899. Since then the business has been carried on by the two remaining partners, Poul Larsen and Alex. Foss.

Design Features of Concrete Arch Bridge at Winnipeg

The recently completed concrete arch bridge over the Assiniboine River at Maryland St., Winnipeg, Canada, provides for traffic between the business section and the best residential section. The deck, consisting of a roadway 50 ft. wide and two sidewalks each 7 ft. wide, provides for four lines of vehicular traffic, including street cars, with a maximum grade of 2 per cent. While this structure as a type of the standard barrel arch class of concrete bridge is not an object of special interest, the proportioning of its parts to form a harmonious whole and the mental processes involved in this proportioning are of considerable interest. An interesting account of these particular features is given by Mr. J. F. Greene, consulting engineer, in a recent issue of *The Canadian Engineer*, from which the matter following is taken.

The determination of the number of spans was not left to the designers. While comparative estimates disclosed the fact that a three-span bridge was slightly cheaper than a two-span structure, and while aesthetic precedent would demand three spans rather than two, the Department of Public Works objected to the location of the south pier in the navigation channel and intimated that only a two-span bridge would be acceptable. The elevation of the crown of the south span was fixed as a result of the clearance set by the government for navigation purposes; hence the curves for the arches had been approximately predetermined, at least enough so to enable one to make preliminary sketches to ascertain how to treat most effectively the abutments, piers, spandrel walls and approaches.

Aesthetic Considerations.—A concrete bridge presents all exposed faces of one color, a dull monotonous gray. These faces in turn, disclose various irregularities, due to the method of constructing concrete structures; each lift, or day's run of concrete is distinctly outlined in any exposed concrete surface; board marks have distinctive entities of different shades of gray, some dark, some light, due probably to the absorption capacities of the several boards; any yielding of forms, no matter how slight, results in offsets or waves; occasionally rock pockets appear much must be covered by disappointing patches. All such appearances are irregularities, all are displeasing to the eye. It is incumbent upon the designers so to proportion the major members of the structure as to make it pleasing and dignified, while at the same time so to accentuate the minor members by the use of pilasters, inserts and grooves as to withdraw the attention from the essential defects of concrete surfaces.

It has been assumed as axiomatic that the dimensions and proportions of the several parts should be indicative of the service which each part contributes to the stability of the whole. The abutments, marking clearly the river banks and the limits of the arch spans, should appear to the observer as of sufficient mass to withstand successfully the horizontal thrust from the adjacent arch span. The pier, while of sufficient mass to carry the vertical loads transmitted from the arches, should present faces so proportioned as to offer the least obstruction to the passage of ice and water.

How the Illusion of Height Was Produced.—With these limitations and axioms in mind, preliminary sketches were made. In one sketch an excessive use of horizontal lines, and in another an equally excessive use of vertical lines, disclosed the basis of the proper treatment for this structure. The structure outlined appeared to be squatty, this quality being exaggerated by the excessive use of horizontal lines and relieved greatly by the appearance of vertical lines. Proceeding from the assumption that the structure lacked depth, abutments and piers were increased in height to a level above that of the handrails; the surfaces were relieved with deep vertical grooves, and even the form boards were placed vertically to further the illusion of depth. The spandrel wall surfaces were broken up by pilasters which in turn were exaggerated by inserts at both edges to accentuate vertical shadow lines, contributing thereby to the depth illusion.

To conceal the results of yielding forms and outline of each day's run, grooves were left in the concrete at regular intervals, both in the arches and in the walls; with each day's run ending in a groove, the line of the joint was concealed and in addition the grooves themselves gave shadow lines which tended to relieve the monotony of the large flat gray surfaces.

Fig. 1—Reinforced Concrete Arch Bridge Over Assiniboine River at Maryland St., Winnipeg, Canada

In proportioning the exposed portions of the sidewalk slabs and brackets, it was expedient to exceed the structural requirements of the design, lest the parts should appear too light for stability. By breaking the sloping side faces of brackets into several vertical faces, an illusion of breadth and strength was produced and the impression which would have resulted from the monotonous succession of plain brackets altered to a definite and pleasing one.

Aesthetic Treatment of Deck.—This completes the consideration of the proportioning of these parts of the structure, which should appear to observers standing either upstream or downstream from the bridge. The treatment of the deck of the bridge presented a separate and a different problem. Smooth, easy ap-

proaches from connecting streets with the least possible grades attainable were desiderata. The elimination, or failing this, the subordination of all trolley and light poles on the deck of the bridge, was adopted as a policy which should be pressed consistently. The design of the handrail, the outstanding portion of the structure visible from the deck, remains. Since the observer views the handrail, not from a distance, as he views the arches, piers, and abutments, but at close range, the appeal to the imagination lies not so much in the tout ensemble, the grouping of the parts into a well balanced whole, as in the excellence of the parts

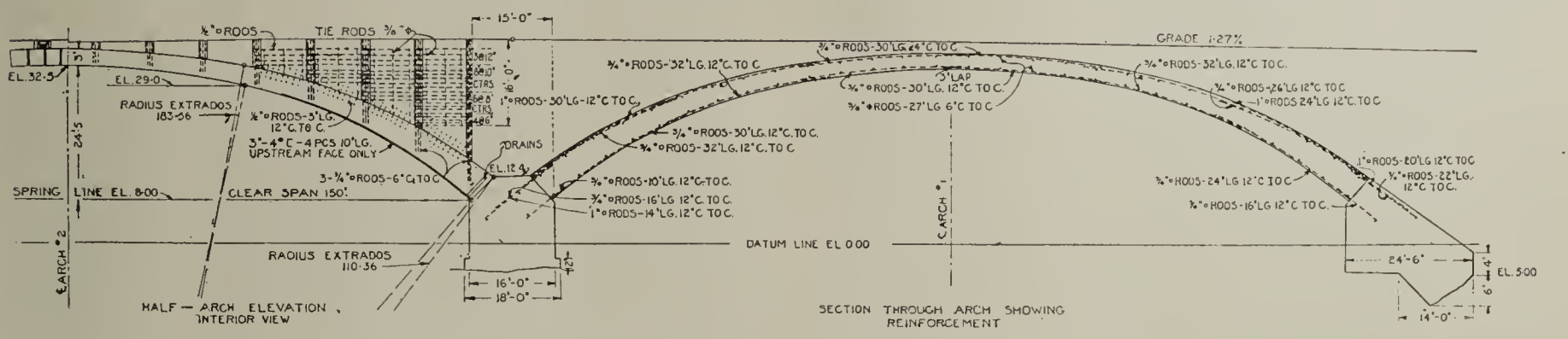


Fig. 2—Details of Arch Ribs and Spandrel Walls of Maryland St. Bridge

themselves, the intricacy of the fabric and the quality of the texture. Hence it is essential that special methods of handling the concrete should be adopted so that the surface irregularities of commercial concrete, such as air holes, water holes, and form marks, would be eliminated. This may be accomplished in various ways, either by the dry process, or with sand moulds, or by scrubbing the surface of green concrete with steel brushes to expose a specially prepared color aggregate. On the Maryland bridge the third method was adopted; the colored aggregate consisting of red granite, crushed to pass a ¾-in. screen, was exposed by scrubbing with steel brushes and cleaned by several washings of muriatic acid and water.

The illumination has been provided through the medium of four-light clusters, set on combination light and trolley poles, standing in the devil strip and located about 90 ft. apart. Each light is diffused by wide angle Holophone Refractors which reduce the glare materially; and the lights have been set high enough on the poles to eliminate dangerous shadows from passing cars.

Principal Structural Characteristics.—A consideration of the structural features may now be in order. The adoption of a solid barrel, earth filled arch, rather than an open, spandrel, reinforced, concrete deck bridge, rested primarily upon economic grounds and secondarily upon structural considerations. With an average fill of 10 ft. the earth fill arch showed a saving of 25 per cent under an open spandrel arch; on the approaches the saving was greater, since the increase in the cost of the deck was not offset by reduction in the substructure due to reduced dead loads. Further, the earth fill type, exposed only at the intrados, is less subject to movement and cracking due to extreme temperature changes than the open spandrel type. In addition the solid barrel type offered greater mass and at the same time less obstruction to the passage of ice.

In the design of the approach retaining walls, a radical departure from standard practice was made in that the foundations for these walls were carried down through more than 20 ft. of excavation, and bonded into the rock. This unusual treatment was due to exceptional conditions at the site. Just east of the north end of the bridge the Cornish baths had given evidence of a strong tendency to move toward the river, and a few hundred feet west of the bridge, several apartment blocks had actually moved and tilted; one section of one of these blocks had been condemned and demolished. The evidence was clear that the bank was not stable and that structures resting on this bank would be equally unstable; hence the reason for the unusual foundations for these approach walls.

Assumed Loadings.—Each arch was designed for a maximum live load of four 50-ton cars with an additional impact allowance of 20 per cent. The arches have been so proportioned that under all conditions of loading the line of resistance lies within the middle third, resulting in a maximum compression of 453 lb. per square inch. The maximum for combined live load, dead load, rib shortening, and a temperature drop of 60° is 652 lb. per square inch and for a temperature drop of 60° the maximum combined stress is 750 lb. per square inch. For tensile stresses due to rib shortening and temperature, steel reinforcement has been provided. Details of the arch ribs and spandrel walls are shown in Fig. 2. In general, 1-in. rods were lapped 5 ft. at splices and ¾-in. rods were lapped 4 ft.

The structure rests upon solid rock foundations. The abutments were designed with the line of resistance within the middle third and with a maximum pressure upon the rock of 9¼ tons per square foot. The rock was excavated to a depth of 6 ft. to provide additional resistance to sliding. The maximum bearing pressure from the pier upon the rock is 11 tons.

The spandrel walls were designed as cantilevers resting upon the arches, the movement from the sidewalk brackets being transmitted through counterforts to the arch ribs. Expansion joints at the haunches provide for lateral movement resulting from the fall of the arches due to a drop in temperature, and at the third points expansion joints predetermine the cracks resulting from the rise of the arches due to a rise in temperature. All joints have been projected to the handrails and appear to be working satisfactorily; those at the junctions of the handrails with the piers and abutments have opened approximately ¾ in. at this writing. All joints in the walls and sidewalks have been sealed by folded strips of sheet lead to prevent the escape of water through the joints with the attendant discoloration of the concrete.

Proportioning of Concrete.—The engineering department had been instructed to use the gravel and rock provided by the Greater Winnipeg Water District at a price of $3.85 per cubic yard for gravel supplied during the winter, $3.00 per cubic yard for gravel furnished during the summer, and $4.00 per cubic yard for crushed rock. The problem, stated simply, was to determine the economical proportions of cement, sand, rock and water, combined to form concrete, which would give an assured compressive stress of 2,250 lb. per square inch at 28 days, i. e., three times the maximum stress in the arches. Pre-

liminary investigations disclosed the fact that there were wide variations in the physical characteristics of different samples of gravel from the same pit. Tests of the gravel showed that the weights per cubic foot varied from 98 to 115 lb., and the percentage of coarse retained on a ¼-in. screen varied from 21 per cent to 48 per cent. Two series of tests were carried out, each embracing the making, and breaking in the testing machine of 60 cylinders 6 in. in diameter and 12 in. long. In the first series, the lighter coarser gravel, weighing approximately 100 lb. per cubic foot was used. The materials were combined in one group to make 1 part of cement to 6 parts of the aggregate, such as 1:1½:4½, 1:2:4, 1:3:3, 1:3½:2½ and 1:4:2; and in another group to make 1:7½, such as 1:2:5½, 1:2½:5, 1:3:4½, 1:3½:4.

In the second series, while similar proportions were used, the gravel itself was more dense, weighing approximately 114 lb. per cubic foot. While no mechanical slump test for consistency was employed, the amount of water used was the least consistent with proper workability. The percentages of water for the first series varied from 6 to 8 per cent by weight of the cement and aggregate, and the water cement ratio was from 0.58 to 0.86 by volume; for the second series the percentage of water varied from 7 per cent to 9 per cent, and the water cement ratio from 0.76 to 1.05.

Compression tests at 28 days showed that cylinders of the first series were approximately 22 per cent stronger than cylinders of the second series composed of the same proportions by volume. Since prudence would dictate that we should base our decision upon the tests of the weaker of the two series, we concluded that the most economical combination from which we might expect to get concrete of the desired compressive strength was 1 part of cement to 3 of gravel to 2½ of crushed rock; while the best results for the foundation concrete containing five sacks of cement to the yard were obtained with a combination of 1 of cement to 4 of gravel to 2 of rock. Complete records of the properties of the ingredients and of the concrete, were prepared and filed for reference.

Tests of Actual Concrete Used.—In order to obtain assurance that the concrete in the structure was of the quality anticipated as a result of the tests, sample cylinders made of the concrete actually placed, were taken daily and tested at 28 days. The concrete placed in the substructure, containing 5 sacks of cement per yard, was very dry, of a consistency such that it would just quake under tamping. The average of the tests run during the months of February, March and April for this class of concrete was 2,100 lb. per square inch, at 28 days. The concrete in the approach walls, containing 6 sacks of cement per yard, was wetter than the foundation cement, but with only enough water to permit spading and consolidating the mass in the thin walls. The average of the tests for the class of concrete placed during May and June was 2,300 lb. per square inch. The concrete in the arches containing 6 sacks of cement per yard was of a consistency such that it would not flow, while at the same time containing sufficient water so that it would quake upon being worked up. The average of the tests for the concrete in the arches at 28 days was approximately 2,800 lb. per square inch. The importance of keeping the water content of the concrete at a minimum consistent with workability was emphasized and impressed upon the construction organization, with the result that we were able to obtain a result which more than equaled our anticipations. The increase in strength from 2,300 to 2,800 lb. per square inch, for concrete with the same combinations of solids but of different consistencies, is significant.

The proportioning of the handrail was the result of cut and trial methods, sample slabs having been prepared of different combinations of the aggregates; these samples, after having been scrubbed and washed, were placed side by side and compared. The proportion adopted was 1 cement to 2½ broken red granite to 1 granite dust to 1½ torpedo sand.

Construction Methods.—The construction methods adopted for this work involved no spectacular operations. The prescribed task was the construction of the new bridge with a minimum of interference with the dense traffic over the steel bridge, the center line of which was west of the new bridge with the floors of the old and new bridges overlapping.

The substructure of the abutments and pier were constructed as units; the superstructure, including arches, walls, sidewalks and fill, was constructed in two parts, the east half of the bridge having been completed and thrown open for traffic before the wrecking of the steel bridge, and the commencement of construction upon the west half. This plan was adopted on the ground of economy, and because operations might be conducted under this method with the least interference with traffic.

The excavation of the abutments begun in December, was carried out with the usual derrick and skip or bucket equipment and was expensive owing to the cold weather. In preparing the foundations for the pier, an orange peel was used to remove a surface layer of rocks and boulders; a line of Wakefield sheet piling was driven from leads suspended from a derrick boom; this piling was backed by a puddle, the combination affording an adequate water-seal whereby the water was kept down within the dam with a single centrifugal pump. In excavations for the abutments and approach walls, sufficient water was encountered to necessitate the continuous operation of pumps.

The concrete plant for the foundations included a paving mixer with a side-loading hopper for which extension leads had been prepared. In concreting the pier, this mixer was placed on cribbing at an elevation high enough to permit of dumping direct from the mixer to the pier; the cement, gravel and rock, placed in the loading hopper with wheelbarrows at ground level, were elevated to the mixer over the extension leads. In concreting the abutments, the mixer was placed on the ground near the edge of the excavation, the aggregate placed in the side loader with wheelbarrows, and the concrete conveyed through chutes to place.

The water and aggregate for concrete placed during the cold weather were heated; the spaces containing concrete were housed and heated for a considerable period after the placing of the concrete; every effort was made to give the concrete the advantage of being cured under conditions approaching normal.

Arches and spandrels were painted with a waterproof paint to increase their imperviousness.

Concreting Plant.—The concrete plant for the superstructure consisted of a bin into which sand and rock were loaded from a bucket elevator, drawing from pits into which gravel and rock had been dumped, from heavy automobile trucks. This plant was so located in the west half of the north approach that it was possible to complete all concrete work without interference from the plant.

The concrete dumped from the mixer into side dump cars was drawn to place over a light wooden trestle by a small gasoline dinky, the engine for which had been taken from the mixer. In placing the concrete for the sidewalk and spandrel walls, concrete buggies were drawn to place by the dinky on flat cars made in part of the

trucks from the side-dump cars. The plant was cheap, eminently satisfactory, and the results were excellent.

The falsework was conventional, except perhaps, in the method employed to obtain the arch curve. In place of the standard practice of cutting the curves from the stringers, wedges and waste blocks and plans were added to build up the curves on plain stringers. Under this method much lumber otherwise worthless was used, and the stringers of new stock were available after use in a condition as good as that of new lumber.

Cinders for the fill were accumulated in an adjacent vacant lot during the first half of the year. These cinders were loaded into dump carts with a light electric Thew shovel and hauled to place on the bridge.

Construction began in December, 1920; the east half of the bridge was thrown open for traffic in August, the west half in November, and the street car traffic commenced on December 1, 1921.

The contract for the construction was awarded to the City Engineer, W. P. Brereton, on a competitive basis, at a price of $250,000, and the bridge has been completed well within the contract price. The project was carried cut with A. L. Cavanagh as superintendent; Allan Cotman, chief draftsman, and J. F. Greene as consulting engineer.

Contractor Makes Ingenious Use of Available Equipment for Central Mixing Plant

With the addition of eight light trucks, equipped with Lee dump bodies, equipment formerly used on road construction with the aggregates distributed along the subgrade, was rearranged and so placed that a simple and efficient central mixing plant resulted. The contract was on Federal Aid Project No. 9, a 4.75 mile concrete road job, 18 feet wide, on the National Old Trails Highway in Madison County, Illinois. The Hug Lumber and Construction Company, of Highland, Ill., were the contractors and the work was done under the supervision of the Illinois Division of Highways.

A four-sack Koehring paver was blocked up until the bottom of the discharge chute was high enough to permit a truck equipped with a ¾-yard end dump body to back under it. On one side of the mixer a platform was built for coal storage, and extended back of the mixer to provide space for cement.

Aggregate bins, previously used, were lowered about two feet and a sixty foot Koehring loader formerly used on the subgrade was placed under the bins, the forward end extending beyond the bins over the charging skip of the mixer.

Aggregates were delivered in gondolas on a railroad siding paralleling the material bins. Sand and gravel were unloaded with an Orton & Steinbrenner clamshell bucket and stored in stock piles or placed directly in the bins. The bins were "V" shaped with gates in the bottom, and were large enough to hold about a carload of stone and a half a carload of sand.

Measuring boxes were placed under the sand and stone compartments in the bins. These were built just large enough to hold the proper quantities of materials for a full four-bag batch. By releasing a gate in the bottom of the measuring hoppers, the materials were discharged into the moving belt of the loader, which conveyed them into the mixing charging skip. Cement was added from the stock piled on the platform behind the mixer.

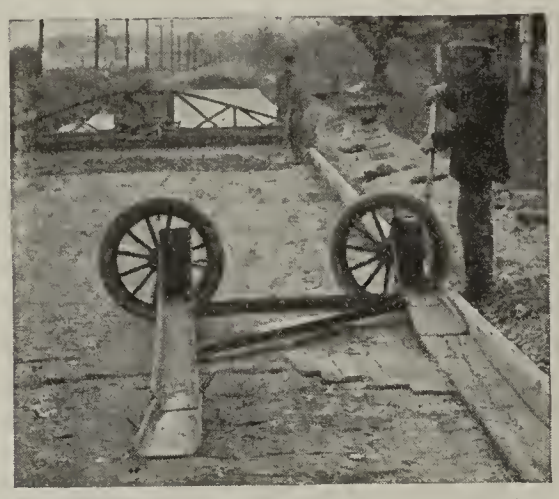
Mixed concrete was hauled to the subgrade in trucks equipped with ¾ yard end dump bodies. With the first set-up, the maximum haul was two miles, with the second two and one-half miles. Eight trucks were used on the first set-up, eleven on the second. The mixed concrete was dumped on the subgrade and finished with a finishing machine. With the relatively dry mix used, no trouble was experienced by concrete sticking to the bottoms of the dump bodies. After dumping, the truck pulled ahead for a few feet and the small amount of concrete remaining in the body was scraped out.

Loaded trucks were turned around on the subgrade by a turntable invented and patented by Mr. Hug. From this they backed to the place where the concrete was deposited. The turntable was set up close to the right form, and when not in operation left a clear space through which empty trucks on the return trip could pass. The turntable consists of two steel track channels, the front ends of which originally were supported on two wide tired iron wheels. The channel on the left side is long enough to receive both wheels on the left side of the truck and is pivoted at a point under the left rear wheel. The right channel is short and receives only the right front wheel of the truck. The front wheels of a truck mounting the obstruction

On the Madison County, Ill., road work the portable concrete plant was converted into a simple and efficient central mixing plant

at the front end with a slight bump. This starts the table turning on a pivot and the traction of the right rear wheel on the subgrade drives it around. Usually the truck will turn the table completely around, but sometimes, especially on grades, a handle at the front is used to help it around. It was found later in the season that the turntable worked more easily by equipping it with pneumatic automobile wheels.

Only three or four seconds were required to turn the truck. One man was stationed at the turntable to help the trucks around and to reverse the position of the table after the truck was turned. To move the turntable ahead, the wheels at the front were turned



This simple turntable enables the concrete trucks on the Marion County, Ill., road work to turn around quickly and without injury to the finished subgrade.

parallel to the track channels and the entire table was pulled forward by two men to its new location.

An average of thirty men were required, distributed as follows:

Unloading Aggregates
- 1 crane operator who did his own firing
- 1 man in gondola to handle bucket

Handling Cement
- 3 men hauling cement to mixer
- 2 men placing cement in charging skip

Loading
- 1 man under bins to charge conveyor

Mixing
- 1 mixer operator
- 1 mixer fireman

Hauling
- 8 drivers on first set-up
- 11 drivers on second set-up
- 1 mechanic
- 1 man at turntable

Placing and Finishing
- 3 men spreading
- 1 man operating finishing machine
- 2 men setting forms
- 2 men curing
- 1 man on water supply

Work was started April 21, and completed December 1, a total of 225 days. Of these 146 full days were lost, 50 days because of weather, 12 because of moving plant and breakdowns in equipment, 60 days because of delay in material supply and 24 days for Sundays and holidays. In the 79 days actually worked, 64,064 square yards of pavement were laid, an average of 811 square yards per day. The maximum number of square yards laid in one day was 1,174.

Dixie Mogul Crusher

The Dixie Machinery Mfg. Co., 3665 Market street, St. Louis, Mo., announces that its new catalog giving full information on the Dixie Mogul crusher is now ready for distribution.

Concrete Pipe Piles in Tasmania

It is reported in the London *Times* that 600 concrete cylinders, constructed by the centrifugal process, are being used in place of timber piles in building a deep-water wharf inside the new breakwater at Burnie, Tasmania. The cylinders are made in 10-ft. lengths, 4 ft. 6 in. in diameter, and the concrete is 12 in. thick. To obtain the requisite height, the cylinders will be placed on top of each other, cemented together, and each joint, completed by an 8-in. steel band. The interior of the cylinder will be filled with sand. The method generally appears to be a variation of the Mouchel cylinder pier system, where reinforced concrete piles are first driven in clusters to provide a secure foundation, and a hollow cylinder of the same material is built up around the piles, the bottom section having a steel cutting edge and the other sections having spigot and socket joints. The interior of each cylinder is filled up with concrete, binding the whole together to form a solid, continuous pier. One disadvantageous feature of the pipe piling described, according to the *Times*, is the doubtful stability of the foundation, and another is the probable lateral weakness of a pier joined in the manner stated, and with nothing better than sand as a central core.

Base and Scratch Coats That Can Be Nailed On

The Compo Stone Co., of Portland, Oregon, is producing and marketing a composition building material in sheets 24x32 inches, one-half inch thick, which can be sawed and nailed to the studding like lumber, without the use of lath.

The inventor, Mr. F. H. Christiansen, states that the material answers the same purpose as the base and scratch coats in ordinary stucco. "Compo Stone" homes are bound to be *dry* homes.

In addition to furnishing "Compo Stone" direct to builders, the manufacturers purpose to lease the equipment for making it, to firms in other sections.

Electrical Repair Problems

Lansing Electric & Engineering Co., Lansing, Mich., believes and has believed in preparedness. They have prepared themselves to cope with every sort of electrical repair problem that can arise in the cement, lime, gravel and crushed stone industries, by assembling the most complete equipment for these industries throughout the United States and by training their staff of engineers and mechanics to the highest point of efficiency.

They carry thousands of pounds of wire, motors, commutators, armature and field coils, generators, etc., for their customers urgent needs.

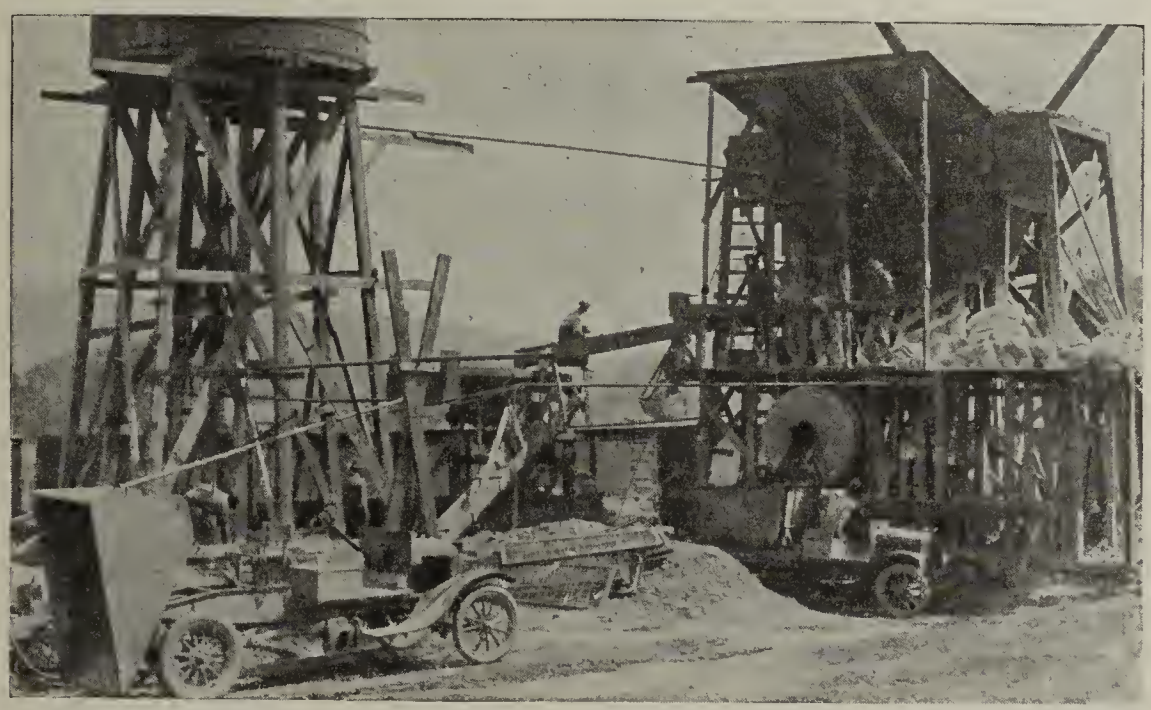
They are in a position to save you money by greatly prolonging the life of electrical equipment which you now think of as "worn out."

Concrete Hauled from Central Mixing Plant on State Highway Job in Walla Walla County, Wash.

By EUGENE R. HOFFMAN
Federal Aid Engineer, Washington State Highway Department, Olympia, Washington

On Federal Aid Project No. 56, a concrete road contract 3.4 miles long in Walla Walla County, Washington, the concrete is mixed at a centrally located plant and hauled in light trucks to the subgrade. Because of the excellent condition of the subgrade and the absence of rain in this locality during the construction season, this method of placing concrete was considered practical by the State Highway Commission, the work to be undertaken at the contractor's risk and subject to the approval of the commission's engineers.

Ford trucks, equipped with Lee dump bodies, were used for hauling the mixed concrete. Trucks backed up under the mixer discharge spout and were filled by a gravity discharge. Each truck hauled 16.25 cubic feet of concrete. The concrete was mixed as dry as finishing conditions would permit; that is, as dry as possible, but not so dry that it could not be finished with hand operated template float and roller. It was found that such a mix did not separate while being transported over the subgrade nor did it adhere to the



On the Inland Empire Highway in Walla Walla County, Wash., concrete was mixed at this central mixing plant and immediately carried to place by Ford trucks equipped with Lee bodies.

A central mixing plant, consisting of a four-sack steam driven mixer, mounted on a platform and placed under aggregate storage bins, was erected at Buroker Station on the Northern Pacific Railway. This siding is located approximately midway between the ends of the project, the maximum haul being to the north end, a distance of 9,800 feet.

Pebbles and sand were delivered by truck and stored in stock piles near the bunkers. A ¾ cubic yard clam shell bucket swung by a stiff-leg derrick loaded the aggregates into a two-compartment hopper above the mixer, each compartment holding 11 cubic yards of material. One compartment held sand and the other, coarse aggregate.

Below each bunker, and above the opening for charging the mixer, were small measuring hoppers, each just large enough to hold the proper amount of aggregate for a batch. These were filled from the compartments above, while the previous batch was being mixed, and held there until the mixer was cleared. By lifting a gate the measuring hoppers discharged directy into the mixer drum. Cement was hoisted by the derrick from the warehouse to a platform near the measuring hoppers and the sacks emptied directly into the mixer. Four pounds of hydrated lime for each 100 pounds of cerent were first added to thhe mixture with the intention of retarding hardening and making the concrete more workable at the end of the haul. This practice was later abandoned as it was found to be unnecessary.

bottom of the trucks as badly as did a wetter mix. All sticking in the trucks, however, was eliminated by the use of a sheet of canvas fastened at the forward end of the Lee body. When in a dumping position the canvas hung from the top of the body and offered no difficulty in its use. Before receiving a new load, each truck body was washed with water from a hose.

Accurate records were kept of the length of time each batch was on the road. The inspector at the mixer noted the time the truck was loaded, on a tag which was taken up by the driver and turned over to the inspector at the other end of the haul, where the time was again noted. On the longest haul (9,800 feet) the average time consumed from the time the truck left the mixer till the concrete was dumped on the subgrade was 12 minutes. The round trip on this haul required about 20 minutes.

The contractor's organization with this equipment was reduced to a minimum. Aggregates were rehandled but once; that is, when they were loaded from the stock pile into the bunkers. The force operating the aggregate-handling plant and mixer was as follows: 1 foreman, 2 engineers, 1 fireman, 1 mixer man, 1 man on cement, 1 man on sand and pebbles, 2 trucking cement. Eight trucks were used on the maximum haul and some of these were released as the haul shortened. Ten men were employed placing concrete, distributed as follows: 5 men spreading and unloading concrete, 2 rodders and 1 finisher, two men building dykes and

sprinkling the finished pavement. Six men were required on subgrade preparation and form setting.

The subgrade was prepared from the beginning of the job to the mixing plant before any concrete was hauled over it. As the work progressed, the subgrade for a short distance ahead of the point of placing concrete was rerolled and reshaped. While the rocky clay subgrade stood up well under the truck traffic, it was occasionally necessary to reshape and reroll the grade. Much of the pavement was built in temperatures of from 90 to 94 degrees, and care was taken to wet the subgrade thoroughly before concrete was placed so that no moisture would be drawn from the concrete. The concrete was covered with wet burlap covers as soon as finished and sprinkled until it became hard enough to dyke and pond.

The pavement which was 20 feet wide was laid at the average rate of 300 feet (666 square yards) per 8 hour day when the haul was from 1 to 2 miles, and 398 feet (884 square yards) per 8 hour day when the haul was 1 mile or less. These figures are the average for the number of working days on which pavement construction was actually in progress.

The work was done under the supervision of the Washington State Highway Commission, J. W. Hamilton, District Engineer, and H. C. Tibbals, Resident Engineer. A. Guthrie & Co., of St. Paul, Minn., and Portland, Oregon, were the contractors.

On the longest haul on the Walla Walla County road work the time consumed by the trucks in hauling concrete from central mixing plant to subgrade was 12 minutes

Education and Fuel Conservation

The average steam plant wastes one quarter of its fuel. The domestic consumer of fuel is even more wasteful than the industrial consumer. The mineral fuels can never be replaced. Once exhausted they will be gone forever, and there is not—as is popularly supposed—an inexhaustible supply. Oil is going fast; anthracite will soon be gone; and the thick-vein low volatile coals of the eastern field are almost gone. The problem of fuel conservation is, therefore, one of world importance to all of the people of all the world.

The many problems that have a bearing upon fuel economy are of vital importance to the individual fuel consumer. He pays for the fuel that he uses and his annual bill depends upon two things, viz: the price per ton or per gallon that he must pay and the quantity that he uses. He has no control—or at the best, the most remote control—over prices, but he does have a large measure of control of the quantity that he uses. The average consumer can reduce the quantity of the fuel that he uses at least twenty-five per cent. This is the estimate of many competent engineering authorities.

Let us, for example, suppose an industrial concern needlessly wasting one-quarter of its fuel. Every dollar that is saved to the fuel account can be passed to the dividend account. Every stockholder of every company relying upon steam power should be deeply concerned with the fuel bill, because fuel is a very large item of manufacturing expense in nearly all industries. We are entering upon days of very sharp competition and the industries to survive will be those that give close attention to the costs of production.

Fuel economy depends primarily upon the education of all those who have anything to do with the final uses of fuel—from the manager in his office, down to the men who actually burn the coal, oil or gas. Knowledge is necessary, no matter how refined the equipment for the utilization of the fuel may be. The more refined the equipment, the more refined the knowledge must be.

The United States Fuel Administration, very early in its short-lived career, realized that education was the real key to fuel economy and it set about a campaign of instruction. The work of the Fuel Administration came to an end with the close of the Great War, but in giving up its campaign it reported as probably its most important finding and message to the country, that the work of conservation must go on primarily through the better education of the American citizen in the theory and practice of Combustion. The man who studies fuel economy is certain to effect fuel economy.

Mr. Joseph W. Hays, who is known internationally through his books on Combustion, with the help of the following, prepared a Course for the purpose of offering the much needed instruction in fuel and Combustion Engineering: Prof. S. W. Parr, of the University of Illinois—one of the highest of all authorities on the chemistry of fuels; Messrs. Fred R. Low, Editor of *Power*, and David Moffat Myers, formerly of the Fuel Administration, both of New York City; Messrs. Arthur L. Rice, Editor of *Power Plant Engineering*, W. L. Abbott, of the Commonwealth-Edison Company and Joseph Harrington, formerly of the Fuel Administration, all of Chicago; and Mr. I. E. Moultrop of the Edison Electric Illuminating Company, Boston. This Course is offered through the Hays School of Combustion, organized in Chicago with principal offices at 1412 S. Michigan Avenue. The School teaches exclusively by correspondence and now has thousands of students scattered throughout all parts of the English speaking world.

Large Hollow Concrete Blocks Form Dock Wall

Block 16x15x3½ Ft. Built in Wharf and Retain Solid Fill—Concrete and Broken Stone Placed in Cells of Walls

A dock-wall or wharf of 18-ton cellular concrete blocks built up like ashlar masonry is a novel type of structure constructed in the enlargement of shipping facilities for the Petoskey Portland Cement Co., at Petoskey, Mich. This wharf, which is for shipping cement and rock and for receiving coal and supplies, is on the south side of Little Traverse Bay and is exposed to the action of waves and heavy ice. As shown in Fig. 1 the construction consists of about 400 ft. of concrete dock wall with filled ground behind it for a width of 400 ft. from the present shore line for a yard and railway trackage. At the west or inner end the upper part of the fill has a mass concrete retaining wall with a maximum depth of 12 ft. 9 in., but beyond this the concrete wall provides 23 ft. of water for vessels.

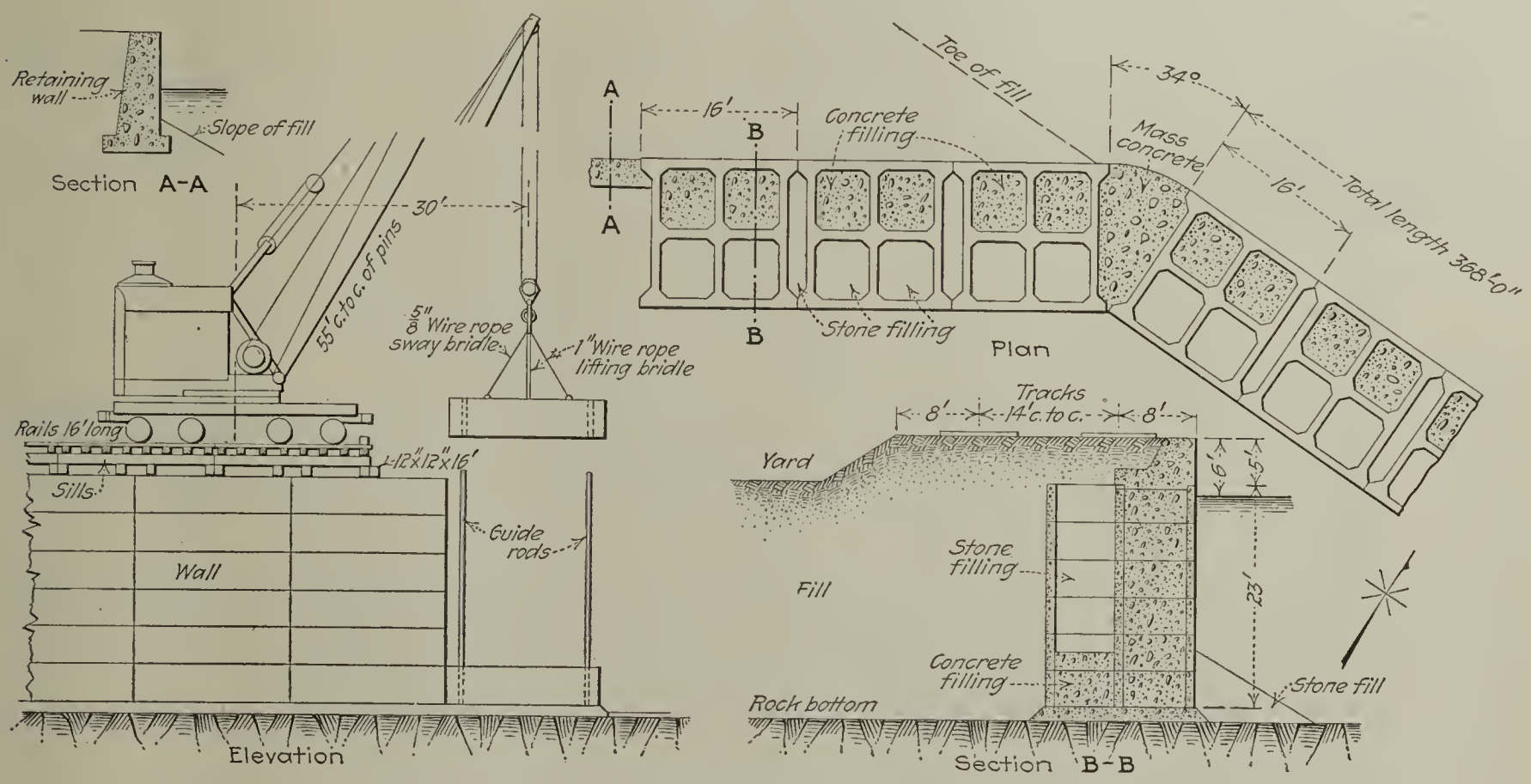


Fig. 1—Dock Wall Built Up of Hollow Concrete Blocks

From the rock bed of the bay the wall is built up of concrete blocks to about a foot above the water line and is capped with 5 ft. of mass concrete, making a total height of 28 ft. to wharf level. This concrete capping has expansion joints at intervals of 64 ft. Its face is protected by two lines of fender timbers bolted to the face and by 3-in. hemlock planking which extends 5 ft. below the water line.

Blocks 16x15 ft. in plan and 3½ ft. high are used in this wall, each block having four large cells, as shown. The walls and partition are 8 in. thick and the front and back walls extend beyond the side walls so as to form pockets between adjacent blocks. These pockets are filled with broken stone. There is no dovetailing or interlocking of the blocks, nor do they break joint, the wall being built up in 16-ft. lengths with vertical joints.

In construction the courses of blocks are lined up and secured temporarily by four 2½-in. vertical tie-rods which are grouted into holes drilled in the rock, these rods engaging cored holes in the corners of the blocks. At one point the wall makes a change in direction and the triangular space thus formed is filled with mass 1:2:4 concrete which is bonded to the wall by the flanges or projections on the face of the blocks. About 200 blocks were required and were made by the cement company at its yards, using a 1:2:4 mix with 1¾-in. stone for coarse aggregate. The concrete was poured in wood molds and left for three days, after which the blocks were removed and stacked for thirty days to cure before being used. Each contains about 9 cu. yd. of concrete and has a weight of 36,000 lb. in air or 21,000 lb. in water. Blocks stored in the casting yard are shown in Fig. 2.

A 25-ton Orton-Steinbrenner locomotive crane placed the blocks, which were delivered in rear of the crane on flat cars. A short length of frame trestle was built to carry the crane while building the first section of the wall. Beyond that, the crane track was laid on

Fig. 2—Concrete Blocks in Casting Yard

the completed part of the work. Sills 12x12-in. and 15 ft. long, were laid across the wall to carry packed stringers of the same size, upon which the track ties were placed. This track was built in 16-ft. sections as the wall progressed.

Before a section of the block wall was commenced the bottom was cleaned by a small sand-sucker or hydraulic dredge, the nozzle of the suction pipe being handled by a diver. The diver also removed loose rocks, attaching a sling or grapple of the crane to

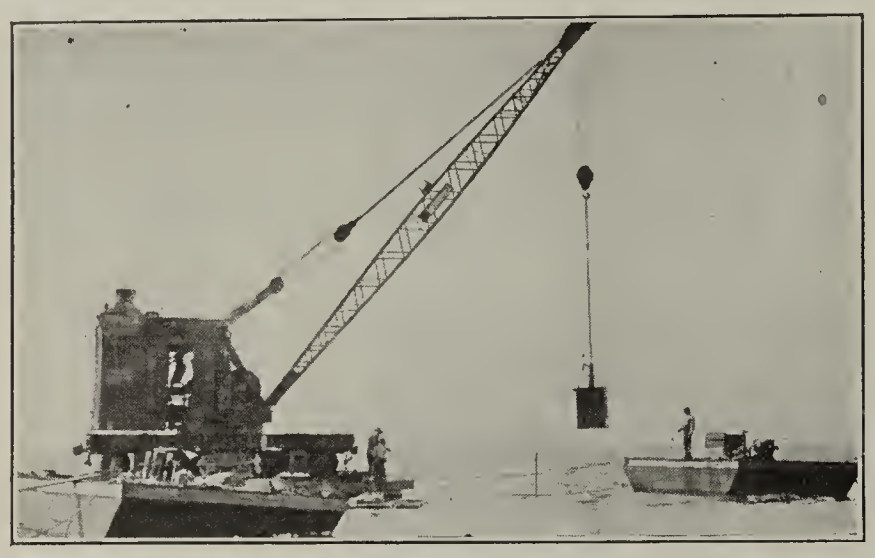


Fig. 4—Depositing Concrete Under Water by Drop-Bottom Bucket

rocks and boulders too large for him to move. The crane then picked up a concrete block from a car in the rear and lowered it into place, guided by the four rods. Stones were placed by the diver to level up the block on the sloping rock bed. The concreting train was then pushed out by a yard locomotive and the mixer, of 13 cu. ft. capacity, delivered concrete to a 27 cu. ft. closed drop-bottom bucket which the crane lowered into the water, so that the concrete was deposited quietly and directly in place to fill the pockets of the block. This concrete flowed under the block, filling all irregularities of the rock surface and the spaces between the stones used in leveling up the rock. A 1:3:6 mix of stiff consistency was used for this filling. Fig. 3 shows the concreting train and the dredge scow. Fig. 4 shows the floating crane handling the drop-bottom bucket. On the scow at the right is the

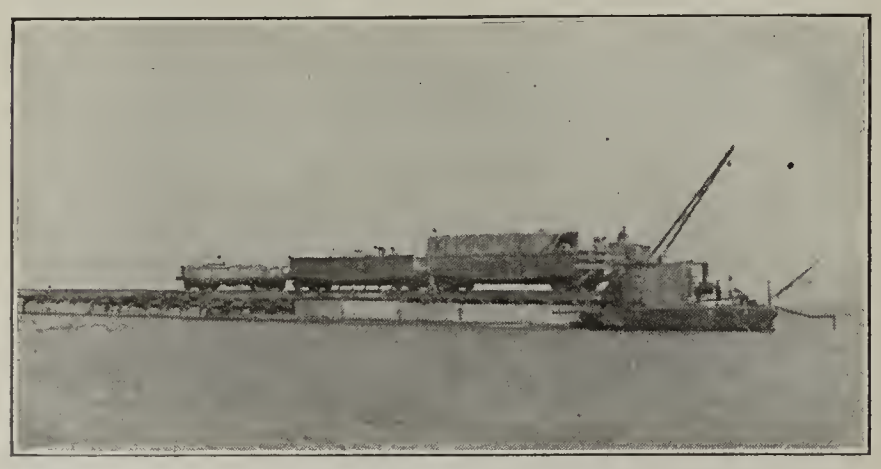


Fig. 3—Concreting Train on Dock Wall

compressor supplying air to the diver who guides the bucket into position.

This sealing or anchoring concrete was allowed to set for 48 hours, after which additional blocks were placed to the full height of the wall. Concrete filling was then completed in the front pockets and 2½-in. stone was placed in the rear pockets by a grab bucket, the stone being run out on flat cars. Following the construction of the wall, the fill behind it was made with earth and loose rock obtained in stripping a quarry of the cement company, this fill being deposited by 16-yd. side-dump cars.

In building the 400-ft. length only one section of wall was damaged owing to a storm, and in that case the storm came up so suddenly as to prevent concreting the blocks in place. Since the bottom block was not disturbed, only the displaced upper blocks were removed and the section of wall was then reconstructed. Part of the concrete wharf has been in service for three years and during two winters heavy ice and high waves were experienced, but it is reported that no damage was done although timber piers in the same district suffered severely. It is expected to complete the work this season. This structure was designed and constructed under the direction of the J. C. Buckbee Co., Chicago, as engineers for the Petoskey Portland Cement Co.

Rusted Sheet Metal Work

The aggregate annual repair bill of home-owners in this country will this year amount to $540,041,769 for one item alone—the replacement of rusted sheet metal work, including leaders and gutters, valleys and flashings. This is the outstanding fact brought out by a survey just completed by the Copper & Brass Research Association.

It is estimated that there are in use in this country at the present time 5,175,000,000 feet of leaders and gutters and that about one billion feet is renewed annually.

The cost of replacements of rusted iron and steel pipe in plumbing is placed at $86,500,000 annually making a total annual rust bill of approximately $626,500,000.

Of every dollar spent in residence construction, 36.1 cents is sent for masonry, 29.1 cents for carpentry, 8.7 cents for heating, 6.5 cents for painting, 6 cents for electrical work, 6 cents for plumbing, 3.5 cents for sheet metal work, 2.9 cents for roofing and 1.2 cents for hardware.

The survey shows that the four last named items, plumbing, sheet metal work roofing and hardware, are the heaviest contributors to the nation's annual repair bill.

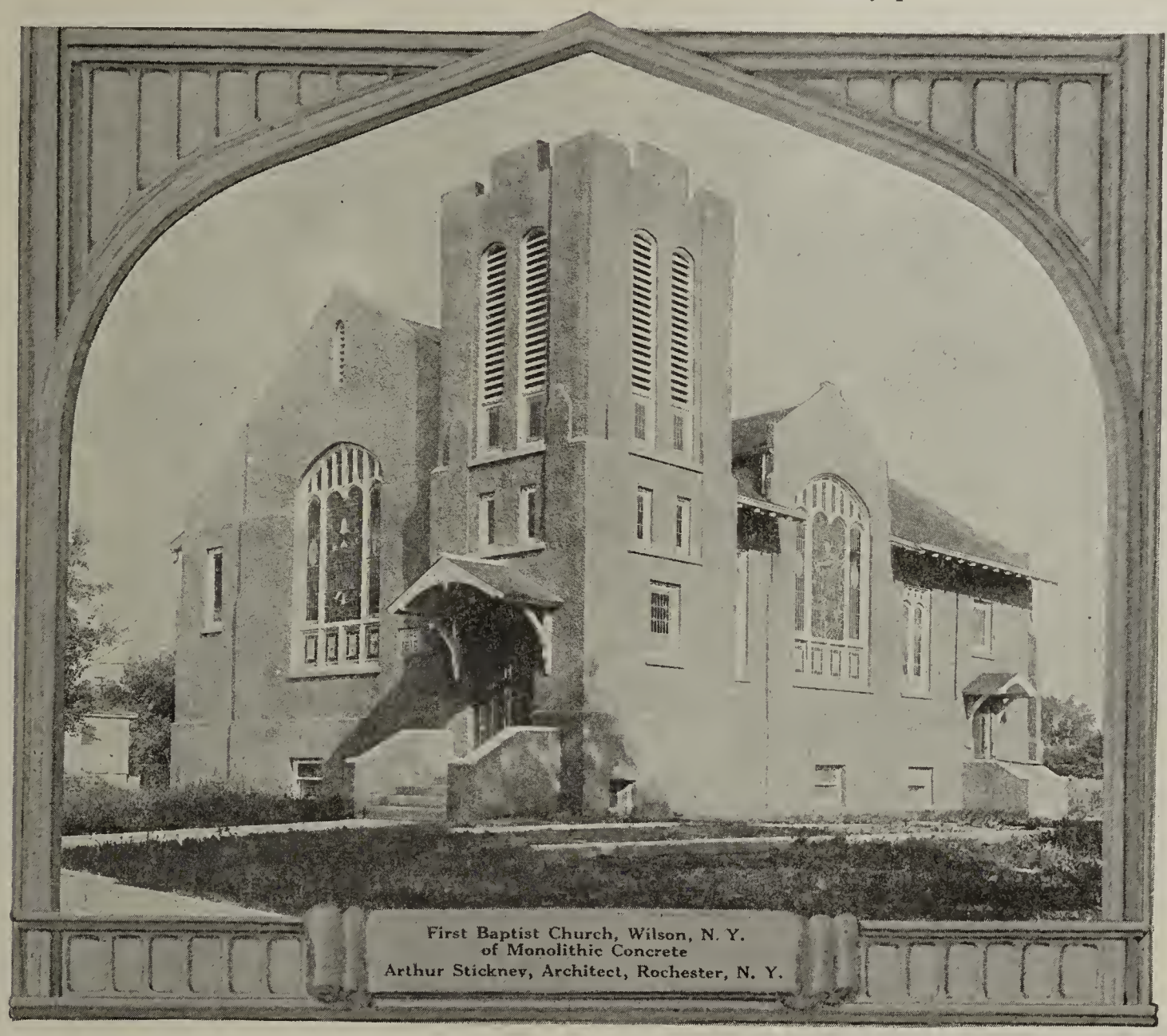
It is estimated that between four and five billion dollars will be spent this year in new construction, a large part of it residential.

Of this amount, approximately $240,000,000 will be spent for plumbing, $140,000,000 for sheet metal work, $116,000,000 for roofinfi, and $48,000,000 for hardware. It is in these items that the largest annual waste for repairs and replacements takes place.

In the Bulletin of the Copper and Brass Research Association, which will be made public tomorrow, it is shown that 3½ mills more on the dollar will provide brass pipe for the plumbing; 7/10 of a mill more on the dollar, copper in the sheet metal work; 2-8/10 cents on the dollar, a copper roof; and ½ of a mill more on the dollar, brass or bronze hardware.

Stucco Church of Double Wall Construction

The photograph shown on this page illustrates the First Baptist Church, Wilson, N. Y. The architect of this attractive structure is Arthur Stickney of Rochester. While not pretentious with respect to size, nevertheless the finished work makes evident concrete's adaptability for church architecture. Walls of this structure were built after the Universal Cement Mold Co., (North Milwaukee, Wis.) system of double wall construction. The exterior is finished with portland cement stucco.



First Baptist Church, Wilson, N. Y.
of Monolithic Concrete
Arthur Stickney, Architect, Rochester, N. Y.

Why One Standard for Portland Cement?

From a paper by P. H. Bates, of the U. S. Bureau of Standards, presented to the Franklin Institute, and entitled "The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use."

At the present time there is but one standard for portland cement, no matter into what use it ultimately goes. Is this good practice? The answer must be in the affirmative if considered from the viewpoint of our present knowledge of cement testing. The practical cement user, however, has answered the question negatively in many cases, when he uses one or more brands in preference to others for certain classes of work or at certain periods of the year. In this connection may be cited the belief that certain brands always produce a non-dusting floor, while other brands produce a dusting floor. In all cases the various brands invariably meet the requirements of the standard. The requirements of the latter do not bring out the differences which usage has found to exist. Hence for certain uses special tests will have to be devised which will determine the desirability of any brand over another for any particular case.

The question arises as to what is a particular case. Should cements for massive construction be different from those for road construction, or for interior pavement, or for sea water or alkali work, or for reinforced concrete? The former does not of necessity demand high tensile or compressive strength like the latter, while for the pavement strength is of relatively minor importance when compared with non-dusting. For sea water or alkali resisting work the physical properties are relatively of minor importance when compared with the need of resistance to chemical action.

High compressive strength can be secured by a high tricalcium silicate content, a silica content of about 20 per cent, a usual alumina content and hard burning of such a raw mixture ground more finely than is usual. Such a cement, however, is brittle, and of low tensile strength after an early age, hence it is not desirable for road work. It commends itself for floors but requires special skill in handling or it will dust continuously. Material changes in our present tests would have to be made to show the value of any marked changes in methods or procedure of manufacture. Earlier strength tests than 7 days would be required; both a tensile and compressive test would have to be considered and a test to determine the co-

efficient of expansion with age. If by change in composition it can be shown that a cement more resistive to salt action can be secured it may be necessary to incorporate further chemical determination in our specifications. The possibility of determining the quality of the cement in a concrete at a late age by an accelerated test, in other words determining its cementing qualities when it has largely hydrated, is worthy of much research. Hence aging at higher temperatures in an atmosphere of water vapor should be a subject of much further and more logical work than heretofore.

To Test Sands for Concrete

Sands unsuitable for concrete on account of the presence of loam or other organic matter are to be investigated by the Bureau of Public Roads of the United States Department of Agriculture and methods of treatment devised to make them safe for use.

Until recent years it often happened that concrete made of good cement and well-graded and apparently good sand, would disintegrate and become worthless. In such cases the poor quality has been attributed to all the different things which go to make a poor concrete.

A few years ago laboratory workers discovered the effect of organic matter in sand and devised a simple test to determine its presence in harmful quantities. The bureau now hopes to find methods of treatment so that such sands can be used. Samples of sand from all parts of the country are desired and the officials request anyone to send in a sample in which the presence of organic matter is suspected.

Kolesch & Co., 138 Fulton St., New York, N. Y., will gladly send any of our readers, without obligation, a booklet describing the "Universal Sand Tester," a simple device for testing sand. You can produce stronger concrete at lower cost, if you know your sand. This device can be used in the laboratory, at the pit, in the plant or out on the job.

Explosives for Stone Quarries

The important relation of explosives to the economical operation of stone quarries, with a description of the class of explosives used and the necessity for proper drilling and blasting, were the subjects of papers read by S. R. Russell of the Du Pont Co. and N. S. Greensfelder of the Hercules Powder Co., at the annual convention of the National Crushed Stone Association.

Probable the largest single item of cost in the production of stone, aside from labor, declared Mr. Russel, is the item of "blasting cost," which includes, of course, both the cost of preparing the holes and of the explosives used in charging them. No attempt will be made to cover blasting in quarries in all its phases—just a few thoughts as to the selection of explosives for quarrying and the important relation they bear to the successful and economical operation of a stone quarry.

It is estimated that more than 60,000,000 lbs. of high explosives were used in quarry and open-pit operations in the United States last year. A conservative estimate of their value would be $10,000,000. If to this is added the cost of black blasting powder—of which a considerable quantity is used in the stone industry—and the cost of blasting accessories, probably the quarrymen paid more than $12,000,000for explosives alone during that year.

Today, almost all the important and successful operators are giving the matter of explosives serious consideration and study, for the manner of blasting affects every subsequent quarry operation—loading, conveying and crushing. If the drilling and blasting are not properly done—and these two operations should be considered together—the result will be a low shovel or loading efficiency, high secondary blasting cost, reduced output through the crusher and a final high cost per ton of stone. The blasting, therefore, is the heart of the whole quarry system and the selection and method of using explosives are vital matters.

Report of Committee on Concrete Block Houses

Presented at the National Conference on Concrete House Construction

In block, brick and structural tile made of concrete, we have three building materials which have survived the most severe criticism and prejudice of their earlier years. Houses constructed of concrete building units more than a score of years ago are still standing and to all appearances are practically as good today as when erected. The durability and stability of this type of construction has been proven conclusively by these earlier houses.

Having withstood the acid test of criticism, concrete building units are now recognized for their true worth as structural materials. Manufacturers have accepted all criticisms as constructive and by constant effort to improve their product have acquired considerably more skill in making these units than the pioneers in the business.

The only valid objection which can be held against the earlier structures is their appearance. The effort to simulate cut stone has been the chief cause of prejudice. Had skilled artisans recognized the structural possibilities of concrete block when they were first invented and used their talent to direct the work, no doubt this objection would have been forestalled. Today, concrete building units are being developed and manufactured which are unsurpassed by any other masonry material, either in regard to appearance or structural soundness.

Concrete building units are designed to occupy a prominent place among building materials. Because of their economy in manufacture and erection, and the low cost of up-keep, and on account of their insulating, fireproof and waterproof qualities, and owing to their permanence, attractiveness and adaptability to all classes of structures, whether built singly or in groups, they are rapidly assuming a leading place in the building material field.

Concrete has been rightly termed "everlasting" and concrete building units may be correctly defined as "everlasting" building units. Time leaves no mark upon them as the years go by. They require the minimum of attention and repair and become stronger with age.

One of the outstanding merits of concrete building

unit construction is the insulation afforded by the air space in the wall. In making a hollow unit, the manufacturer has achieved a double purpose, he not only has reduced the amount of material that would be necessary for solid wall construction but has also furnished a good insulating medium. Houses constructed of concrete building units are comfortable at all times, cool in summer and easily heated in winter.

Speed of erection, a point always foremost in the minds of contractors and builders, is one of the chief advantages of these easily handled units.

One of the accepted practices of the building industry is to use those materials nearest at hand. Concrete aggregates, common to most localities, constitute the principal materials used. Thus the use of concrete building units reduce the demand on our transportation systems to a minimum.

At present, approximately 4,000 concrete products plants are in operation in the United States. No great outlay of capital is necessary to build and equip temporary products plants, such as would be suitable to establish at points where extensive building operations are in progress. In such locations quick delivery of manufactured units to the building site is assured. A well equipped plant operates the year 'round and a reserve stock of concrete building units may be made during the winter months for the following summer's use.

Due to the plastic nature of concrete, building units made from this material are subject to a wide variety of architectural treatment and are suitable for all types of buildings, from a small and unpretentious home to a stately mansion. Already they have been used in extensive projects involving the construction of many homes.

So numerous are the treatments to which the surface of these units may be subjected that they may be used for the construction of every house in a city block without repetition of surface texture or color. The design of every house in a community may be varied with these flexible units without materially increasing the cost.

The demand today is for a material with which individuality can be expressed and at the same time one which meets all the requirements of permanence and economy. Concrete building units more readily meet these requirements than any other form of permanent building unit.

The concrete building units herein referred to are more specifically defined in the report of Sub-Committee B. This report treats the entire subject of houses built of concrete building units in a general way as the details are fully discussed in the reports of the various Sub-Committees which will now be presented.

Concrete Fuel Oil Tanks at Panama Canal Terminals

Marked Saving in Cost by Using Concrete

Three 55,000-barrel tanks of concrete construction for the storage of fuel oil have been erected among the steel tanks on the oil farms at the Canal terminals. One was erected at the Atlantic terminal in 1919; and one has been completed at each terminal this year.

The first concrete tank was 117 feet in outside diameter, cylindrical in shape, 30 feet high from floor to top of the wall. The floor was made 6 inches thick, stiffened with 5 rows of beams each way. The beams were 3 feet wide by 1 foot deep. The capacity of the tank is 55,000 barrels of 42 gallons each.

The walls were made 6 inches thick on top and 12 inches thick at the bottom, thoroughly reinforced with circumferential steel rods, and enough vertical rods to prevent temperature cracks.

The roof of this tank was made of No. 10 gauge steel plate, supported on a steel channel and at beam sections, with 25 pipe columns filled with concrete.

A special treatment was applied to the inside of the walls to prevent leaking. This treatment is described in Bureau of Yards and Docks specifications for coating interior surfaces of fuel oil reservoirs. A hydrostatic test is made on this type of a tank by filling it with water, which gives higher pressure than crude oil, due to its greater weight.

The two tanks constructed this year differ from the one described above, in that the later tanks have solid concrete roofs supported on concrete beams and columns. Considerable saving in money was made by the use of these roofs. Much less time is required to complete this type of a roof than a steel one. At the present time several months are saved by constructing entirely of concrete. Less than one month is sufficient to complete the pouring of a tank.

Of the two tanks built this year, with concrete roofs, that at Cristobal cost approximately $47,300, and that at Balboa approximately $53,000, the difference being due to the additional cost of excavating on the site at Balboa. It has been estimated that the concrete tanks are about $70,000 cheaper each, than steel tanks of equal capacity, and they were built much more quickly than steel tanks could have been under present delivery conditions.

New Cement Mill for Michigan

Announcement has been made by officials of the New Egyptian Portland Cement company, Fenton, Mich., of the closing of the lease with the Grand Trunk Railway company for the State street shops at Port Huron, Mich.

This means that Port Huron is to have a cement plant upon which work will begin at once and which under present plans, will be producing 1,500 barrels of cement a day by February next.

Some time ago the organization of this new company was announced and it was proposed to go ahead at that time with the building of the plant, arrangements having been made for the property. It was discovered, however, that the Grand Trunk railway, under its grant from the government, was not authorized to lease the property to any other concern and it was necessary to get an act of congress to clear away this obstacle.

The bill for this passed both the house and the senate and has been approved by President Harding.

While this has been going on, negotiations for the lease were in progress and as soon as the act was signed by the president a 20-year lease was signed with an option of an additional 20 years at the expiration of that time.

The New Egyptian Portland Cement Company recently raised capital stock from $500,000 to $1,000,000 to provide capital for the building and operation of the new plant in Port Huron. Machinery, which will cost in the neighborhood of $400,000, will be installed.

Conveyors will be built at once in order to unload rock which will be brought down from Calcite this fall before navigation closes, so that the plant will be ready for production in the early spring. With water transportation for coal and lime rock, Port Huron is said to be particularly well located for a cement plant.

The State street shops are large enough, it is declared by officials of the concern, to accommodate three units, the first of which will be immediately installed and will, as stated above, be capable of producing 1,500 barrels of cement a day.

Officers of the concern are as follows: President, John Gillespie, of Detroit; vice-president, Charles A. Bray, Detroit; secretary-treasurer, Edward R. Sullivan, Fenton, Mich.; directors, Maynard D. Smith, of the A. J. Smith Construction company; William M. Hatch, of the National Portland Cement association; C. A. Smith, general superintendent of the New Egyptian Portland Cement company, and John A. Acker, consulting engineer.

Hydrated Lime in Railroad Shop Buildings

The question of how and why does hydrated lime improve concrete construction is one which is being given careful consideration at the present time. The fact that it does serve as a means of making good construction better is accepted by a large proportion of users of concrete.

When the Atchison, Topeka & Santa Fe Railroad decided to erect some new shops at Albuquerque, New Mexico, they gave careful consideration to all materials to be incorporated in the finished structure.

Hydrated Lime Specified.

As a result of their study, the engineers specified that 5 per cent by weight of hydrated lime should be added to all concrete. The result is clearly shown in the accompanying photographs. It is interesting

to note the uniformity of the concrete, and its light color. That the forms were well filled, and that the concrete was dense, may be easily seen. Where smooth forms were used there was practically no finishing necessary.

Benefit Derived from Lime.

The results obtained by the use of hydrated lime in concrete are fourfold. It has proved its effectiveness in making the concrete permanently watertight. It offers the user distinct advantages in placing the mix usually resulting in a saving which more than offsets its initial cost. It reduces segregation and the danger of stone pockets or improperly filled forms and it lightens the color of the finished structure, giving it a clean, light tone which is attractive and pleasing to the eye.

Volume Changes Reduced.

Changes of volume due to variations in the moisture content of the concrete are primarily due to the presence of open voids in the mass. If these voids were sealed, the water could not cause this expansion, and consequently the effect would be eliminated. Even though it is impossible to entirely do away with the difficulty, it may be greatly reduced by filling the voids with hydrated lime. The lime will prevent water from occupying the void space, and so, besides making the concrete watertight, which is particularly necessary below grade, it makes the walls above ground more durable. The reinforcing steel is protected and the clean smooth surface of the wall is preserved.

These advantages may be gained by adding hydrated lime in sufficient amounts to insure a watertight job. A saving, and at the same time an increased value is obtained. Every contractor is in-

terested in the saving, as well as the owner, and both are likewise interested in securing the highest class of work possible. The results are actually secured in the field and under practical working conditions, which is essential, as buildings are never erected under laboratory conditions. Practical success is the test demanded by users of any material, and hydrated lime has passed all the tests imposed by the construction industry.

A Correction

In the August issue of CEMENT AND ENGINEERING NEWS on page 20, appeared an article pertaining to the Carbon Limestone Co., entitled, "Operating a Pennsylvania Quarry on three levels," in which we state, that the screenings are pulverized in a Gruendler Pulverizer, this is an error on our part as several months ago the Carbon Limestone Co. installed a Bradley Hercules Mill for this purpose, same replacing a ball type compartment mill, the Carbon Limestone Co. are very well pleased with the Bradley Hercules Mill.

Belt Conveyors

Bulletin 369 shows illustrations and descriptions of the new material-handling product, the Jeffrey portable belt conveyor, manufactured by the Jeffrey Mfg. Co., Columbus, Ohio.

Glass Sand Company Finds Concrete Bins Economical

The Berkeley Glas Sand Co. of Berkeley Springs, W. Va., has provided modern facilities to store and ship sand used in the manufacture of glass by building overhead reinforced concrete storage bins.

The storage structure is 16 by 100 feet in plan supported by concrete columns spaced 12 feet 6 inches center to center. The storage space is divided by transverse partitions into four compartments each 17 feet deep, 16 feet wide and 25 feet long. The entire structure is of reinforced concrete. Pillasters built in continuation of columns midway between compartment partitions reduce the side bin wall spans to 12 feet 6 inches center to center. These walls are 4 inches thick at the top and 10 inches at the bottom, suitably reinforced. End walls, because of their longer span of 16 feet, are 5 inches thick at the top and 11 inches at the bottom.

The bin floor is supported on main cross girders at each pair of columns, spaced 12 feet 6 inches center

With no expense for maintenance or repairs, these concrete bins contribute to the efficient operations of the Berkeley Glass Sand Co., Berkeley Springs, W. Va.

to center, while four secondary beams running longitudinally and built into the girders and spaced about 5 feet 2 inches center to center carry floor loads to the main cross girders. The 6½-inch floor slab is thus divided into panels of clear dimensions of 4 feet 2 inches by 11 feet 2 inches. The entire floor system supports a live load of 1,800 pounds per square foot when the bins are full. Bins are filled by means of a belt conveyor running above them throughout the full length of the structure. Freight cars on the sidings are filled through spouts connected to the bins through openings in the floor.

Nelson E. Perin, Treasurer and General Manager of the Berkeley Glass Sand Co., says that during the two years since this plant was built and has been in operation, it has never caused any trouble nor required any expenditure for repair or maintenance. The structure was designed and built by the Lewistown Foundry & Machine Co., Lewistown, Pa., manufacturers of sand crushing, grinding, washing and drying machinery, which also supplied and installed all mechanical equipment under the uspervision of Edwin Cross, its Superintendent.

Engineering Accomplishments

The engineering achievements of the Westinghouse Electric & Manufacturing Company, since its organization, afford inspiration to all its employees, the electrical industry and the public. Everyone knows, or should know, that a large proportion of the electrical engineering developments of the world originated at East Pittsburgh. Everyone knows, or should know, it was there the alternating current system was introduced in America, the alternating current system with parallel connected transformers, the polyphase alternating current system for general purposes, the induction motor, the general type of field construction consisting of a cylindrical yoke with radial poles and magnetized windings on each pole, the original high frequency system of 133 cycles, the single reduction railway motor, slotted armature railway generators, series or two circuit armature windings, opening an arc on a carbon contact, the A.C. voltage regulator, the tooth type alternator, the ironclad railway motor, two-phase to three-phase transformation (the list could be extended almost indefinitely). In the course of quickly passing events, it is probable that comparatively few realize that this engineering progress is going on incessantly, but this is the case, and the year 1922 has been no exception to the rule. Rapid strides are being made in the development and application of electrical equipment, which are making possible the more economical generation and use of electrical power, with a material saving in our natural resources.

Cement Paint for Stucco

By A. C. Newberry

Medusa Cement Paint will freshen the appearance, fill and cover the cracks, make the stucco waterproof and give the new, bright, clean appearance of new Stucco.

The cost is trifling, the application simple and the coating is permanent.

Medusa Cement Paint is produced, after years of experiment, by the manufacturers of Medusa Cement. It is made on an entirely different principle than oil paint, being a dry powder which is designed to be mixed with water on the job. It mixes readily, forms a perfect emulsion with water and speads smoothly and easily. The presence of moisture both while paint is being applied and thereafter serves only to increase its tenacity, strength and hardiness instead of preventing perfect adhesion as is the case with oil paint. Medusa Cement Paint forms a smooth, semi-matte, permanent waterproof and damp-proof coating which is an integral part of the Stucco surface. Unlike oil paints it does not deteriorate in the slightest degree with age and exposure to moisture.

Medusa Cement Paint will bond perfectly with all concrete, brick, tile or steel surfaces and is particularly useful in rendering water-proof and damp-proof leaky tile, masonry and concrete basements.

Medusa Cement Paint is a dry powder designed to be mixed with water. (Exactly 10 lbs. of paint to 2½ quarts of water.) Colors: At present Medusa Cement Paint is produced in White, Cream-Buff and Stone Gray. At an early date we expect to produce this material also in Red, Green, etc.

One pound of Medusa Cement Paint dry powder when mixed according to specifications will cover 12 to 15 sq. ft. of surface on concrete, stucco, cement, tile, brick, etc.

Medusa Cement Paint, manufactured by Sandusky Cement Co., Department E., Cleveland, Ohio, assuming minimum covering capacity of 2 coats to be 120 sq. ft. for 10 lbs. Retail cost in 10 lb. cans F. O. B. factory $2.00. Cost per 100 sq. ft. $1.67.

Competitive cement paints, practically all of which are composed in considerable part of oils, assuming minimum covering capacity of 1 gal, for 2 coats to be 150 sq. ft. Retail cost F. O. B. factory $3.50. Cost per 100 sq. ft. $2.33.

Note—Slipshod and careless work must be avoided to secure good results Accurate measurement of the water added and careful, painstaking workmanship will produce very attrctive and satisfactory results.

New Sauerman Portable Power Drag Scraper Outfit

To meet the requirements of the man who is handling material in a small way, especially the county road commissioner or contractor who wishes to utilize a local sand and gravel deposit, a new type of portable power drag scraper outfit has been placed on the market by Sauerman Bros., 1139 Monadnock Bldg., Chicago.

The new outfits are equipped with "Crescent" type power scrapers, which are especially suited for use

Sauerman Scraper working in gravel bank

with a light power unit as they are easy to pull and travel straight. The double drum hoist is furnished with gasoline engine direct connected, or is arranged for belt drive from tractor or other motive power. The truck frame is of heavy steel channel construction mounted on broad tread, grooved steel wheels with steel axles.

Any laborer on the job can operate a Sauerman portable scraper outfit. One man handles the entire operation through two levers placed side by side. There is nothing for another man to do, for the scraper just has to be dragged back and forth, loading and dumping being accomplished automatically at the will of the operator. The front drum of the hoise operates the "load" cable wihch leads through a sheave from the drum to the bridle chains on the front of the scraper. The "pull-back" cable leads from the rear

Gasoline engine driven power unit of Sauerman Portable Scraper Outfit

drum through another sheave out to a guide block at the far end of the excavation, and then is attached to the rear bridle chains of the scraper.

The entire outfit can be made ready to move in a jiffy and in less than an hour after arriving at new location it can be in operation. In moving from one set-up to another, simply wind the cables on the drum, disconnect the bridle cable, put the scraper and blocks on the truck, hook on the tractor, motor truck or team, and pull out. At new location sink the wheels of the power unit into the ground, connect bridle cable to new stakes or deadmen, locate guide blocks, haul out the cables, hook onto scraper bucket, turn over the engine and go.

These little outfits are modest in price, yet embody the same quality features of design and construction that are found in the large Sauerman power scraper and dragline cableway excavator equipment.

The Sullivan Spader

The Sullivan Machinery Co., 418 Gas bldg., Chicago have just issued a new bulletin describing the Sullivan Compressed Air Spader, or Pneumatic Clay Digging Tool, known as Class "DE-361." This tool consists of a light Sullivan air hammer, weighing only 16 lbs., with a length of 17 inches, and requiring ½-inch air hose. It is equipped with a steel spade and special retaining ring or bushing. The bushing and spad are of the well known Bronson pattern.

Remarkable results have been secured by these Spaders in excavating stiff clay in trenches, open cuts, caissons and tunnels in which the ground is not sufficiently hard to be drilled and shot, and yet is too hard to be handled readily by the ordinary pick-and-shovel method. This spade really takes the place of

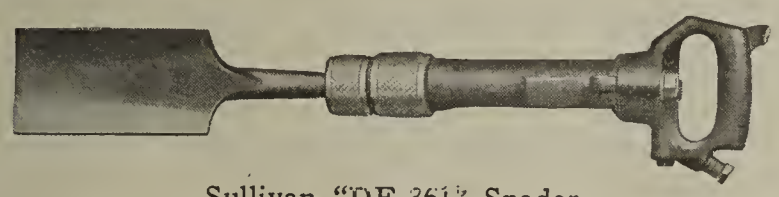
the hand pick, as well as of the hand spade or shovel, in this work.

The application of compressed air to work of this class is a very important step in advance and means a large reduction in labor costs, together, with increased speed of construction on a large variety of jobs.

In tunneling in blue glacial clay, very hard and dry, in the Chicago district, compressed air spades increased the output per miner from 3 to 4 cubic yards per eight-hour shift, to from 8 to 10 cubic yards, and the limit of the work accomplished was governed by the ability to get rid of the muck instead of by the rate of digging, as formerly.

Description of Details.

As will be noted from the illustration, the Sullivan Spader consists of a cylinder, provided at the rear end with a handle secured to it by side rods, and



Sullivan "DE-361" Spader

at the other with a special retainer for holding the steel spade in the nose or chuck of the hammer. A hollow, cylindrical or shell valve is employed, operated by differential pressure. The hammer or piston runs up inside the valve itself, thus providing a long stroke without excessive length of tool, or undue waste. The drill is operated by pressure on a trigger or thump throttle placed at the top of the handle grip where its action will not be hindered by an accumulation of mud or grit.

The Spader strikes a hard, snappy blow, giving abundant power for the work to be done, and satisfactory work can be accomplished at any air pressure from 45 lbs. to 100 lbs., although the higher range of pressure is strongly recommended, particularly for stiff ground.

Eliminates Guesswork in Concrete Products Factories

The guesswork and mistakes of careless labor are eliminated in the Kent continuous mixer, which is specially designed for concrete products plants. The automatic force feed proportioning device absolutely guarantees the accurate proportion of materials whether they are wet or dry. This feature aids greatly in securing a uniform and thorough mixture. The Kent mixers have proven their reliability in a great many of the leading concrete brick, block and tile factories throughout the world, and are approved by leading engineers and manufacturers. Seventy per cent of the bigger block, tile, brick and specialty concrete products plants of the country use the famous Kent mixer. They save labor, because they perform the measuring, dry mixing, wetting, wet mixing and discharging. They save money, because they shorten your pay roll, and because they operate continuously, thereby greatly increasing the daily output of a cement block or tile machine.

Dryers for Coal, Sand, Cement Materials, Lime, etc.

While a dryer is an apparatus for driving off free moisture from materials, it does so by the application of heat or by air absorption and is thus distinct from a dehydrator, which extracts moisture by mechanical means, and from a calciner, which drives off the combined moisture and other volatiles by roasting at a high temperature.

As different materials require different kinds of treatment in drying, naturally, no one type of apparatus can be adapted to all drying processes. The Ruggles-Coles Engineering Co., 50 Church St., New York, N. Y., have designed and now build eight distinct types of drying machines which cover the whole field of drying as completely as possible. Their new No. 16 catalog describes each type and the uses to which it may be put. Send for a copy.

It occasionally happens that no one of their standard dryers can be adapted to a peculiar drying problem. In such a case they modify one of their regular types of dryers or make special apparatus to meet the individual requirement. With over twenty-seven years of experience in this line of work, together with the fact that they have installed over one thousand machines up to January 1, 1921, they are confident of being able to handle any problem in drying which may be submitted to them.

Pulverizer With Air Separation

The Bonnot Co., Canton, Ohio, has issued a 12-page folder describing the uses of the Bonnot pulverizer, a complete grinding unit with air separation. Its special features of design and construction are shown in this folder, illustrated by half-tone engravings and blueprints.

Anderson Oil Engines

A new bulletin—No. 26—has recently been issued by the Anderson Foundry & Machine Co., Dept. J., Anderson, Ind., describing and illustrating the Anderson oil engine. The book is devoted largely to illustrations of these engines in actual operation, and testimonial letters from the users, including a number of pit and quarry operators.

Motors

The Allis-Chalmers Co., Milwaukee, Wis., has issued bulletin 1124 describing the general construction of its synchronous motors, and their applications in the industries. The bulletin also shows illustrations of installations and the services to which these motors are put.

News of the Cement Mills

The Southwestern Portland Cement Co. is making improvements in its mills at Victorville, Cal., that will increase its daily producing capacity from 2,400 bbls., as at present, to 3,500 bbls. The new equipment being installed consists of a Vulcan rotary kiln, 9 ft. dia. and 200 ft. long, and an Allis-Chalmers 7-ft. by 26-ft. wet-grinding compeb mill for the raw-grinding department. The latter will be driven by a 500-h.p. synchronous motor, provided with magnetic clutch. The motor will be directly coupled to the compeb mill shaft.

The new kiln being installed is similar to the two now in operation and will be served by a new concrete stack, 90 ft. high, 9 ft. 7 in. dia. at base and 6 ft. dia. at the top.

The rock-handling and quarrying capacities are being increased by the purchase of a Vulcan locomotive and additional cars, and an electric-power line is being extended from the mill to the quarry, a distance of 5 miles, to supply energy for driving air compressors required in drilling operations.

A general reduction of 20 per cent in all freight rates in cement throughout the state of Oregon is made in an order of the public service commission issued yesterday in its consolidated cement cases of 1921. The order is made effective June 26.

It is said that this is in keeping with similar reductions which the commission has made in other building materials. The order says there is a guarantee for a "full reflection of these reductions in the producers' prices to the consumers of this state," and adds that "it is believed that no greater encouragement could be loaned to the oncoming season of building and construction."

Many Are Interested

The case on which the order is based involved complaint of the Oregon Portland Cement Company, the Portland Traffic & Transportation Association and the state highway commission, with the Beaver Portland Cement Company as intervenor. Also it involved an investigation on the commission's own motion, with an allegation of higher rates charged for cement in Oregon than apply in adjoining territory and on iterstate shipments from competitive mills located in California and Washington.

"To the extensive state highway construction program," says the order, "as well as such projects of counties, cities and municipalities generally, and rural districts i their road building, irrigation works, drainage projects and general building, these transportation concessions should insure stimulation, and all will profit in the reductions ordered.

Home Industry Favored

The order points out that the reduction favors home industry while the present rates favor foreign competition.

"The commission finds that the competition which Oregon mills encountered has resulted in the Oswego and Gold Hill plants losing much business to California mills, in the Willamette valley particularly, and that a more equitable adjustment of the present rates will prevent this situation."

While nothing has been heard recently from the Southwestern Portland Cement company which has purchased a large tract of land west of the city of Waco, Texas, on which to locate a plant, the general understanding is that business in that respect will pick up some time next fall.

The ground purchased by the company had been used, a portion of it, for Rich field, and there are several government claims pending. It is thought that the plan is to get these claims settled if possible before entering upon the land for the purpose of erecting buildings and putting in machinery. The understanding is that the Waco plant will cost about $2,000,000 and will be one of the largest in the holdings of the company, which has several other similar plants.

The Chamber of Commerce, of Waco, Texas, probably will be notified before actual work on the plant is undertaken, as that organization was responsible for securing the cement plant.

After the war ended the business interests of Nashville, Tenn., organized the Nashville Industrial Corporation and took over the great Old Hickory powder plant that the government had built near that city. Of the 5,700 acres of land included in the property 1,000 acres have been turned back to farm purposes and 300 acres sold or leased for industrial purposes. The Old Hickory industrial enterprises include a $1,000,000 Portland cement company, which expects to produce 2,000 barrels of cement a day; a concern that will manufacture electrically driven farm pumps and operate a foundry; a paper mill that will use short leaf pine and produce 75 tons per day of sulphate pulp for kraft paper, container board and corrugated paper stock; a motor and body manufacturing company; a food products company, which will manufacture syrup, starch and by-products from sweet potatoes.

If practical vision and community spirit had been lacking in Nashville this great war plant might long ago have been wrecked and junked. But the people of Nashville had practical vision and community spirit and now the property that the government constructed at a cost of so many millions of dollars is being developed as a great industrial center.

R. C. Monday, contractor, Knoxville, Tenn., has been placed on the board of directors of the Hermitage Portland Cement Company, Nashville, a new corporation just launched with a capital stock of $1,500,000. The Old Hickory powder plant has been taken over by the concern and will be converted into one of the most modern cement establishments in the entire country.

John C. Vance, of Chattanooga, head of the John C. Vance Steel Company, is to be the head of the new venture. He will be president of the company on its initial organization. Associated with him in the organization at the sales end will be John S. Fouche, of Knoxville. T. L. Herbert, Jr., of T. L. Herbert & Sons, large building supply dealers of Nashville, will also be connected with operations. The general manager will be R. T. Miller, formerly Chicago manager, Pittsburgh Testing Laboratory.

In addition to those named the directorate is composed of S. S. Price, a capitalist of Chattanooga, and R. A. King, of Chicago.

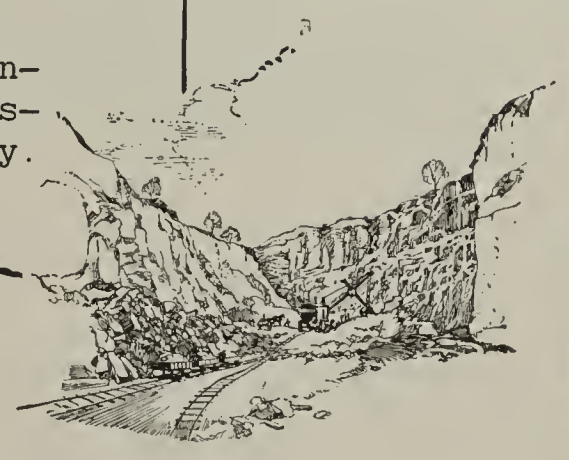
1/3 more per dollar

Excerpt from a letter written by a large user of Dumorite for quarry operations

Some of the original, experimental Dumorite was shot at our quarry last November. The results of these shots were very good and justified further trial. Therefore, as soon as this new explosive was placed on the market we started using it.

The results from Dumorite continue to be economical and very satisfactory. We have found that we use less of this explosive than of that previously used at a reduced explosive cost per ton rock quarried.

Our men like the non-headache and non-freezing features. It is a very satisfactory explosive for use in our quarry.



DUMORITE *Has Proved Itself*

IT went out proved in our laboratories, proved in our experimental field tests and ready for the verdict of the men who actually do the work.

The above excerpt from one of many letters we have received is definite testimony that Dumorite has made good on the job.

Dumorite, the newest Du Pont Explosive, has approximately the same strength, stick for stick, as regular 40% dynamite. But a case of Dumorite contains 35 to 40 more sticks than a case of "40%" and sells for the same price. Write our nearest branch for full information.

E. I. du Pont de Nemours & Co., Inc.

Explosives Department

Wilmington, Delaware

Branch Offices:

Birmingham . Ala. — Duluth . . Minn.
Boston . . Mass. — Huntington, W. Va.
Buffalo . . N. Y. — Kansas City . Mo.
Chicago . . Ill. — New York . N. Y.
Denver . . Colo. — Pittsburgh . Pa.

Branch Offices:

Portland . . Ore. — San Francisco, Calif.
St. Louis . . Mo. — Scranton . . Pa.
Springfield . . Ill. — Seattle . . Wash.
Spokane, Wash.

Du Pont Products Exhibit, Atlantic City, N. J.

NON-HEADACHE DU PONT NON-FREEZING

DUMORITE

THE LATEST OF A COMPLETE LINE OF DU PONT EXPLOSIVES

News of the Concrete Products Factories

Fog nozzles or spray nozzles are being used successfully in concrete products plants. They are devices which are made to attach to water pipe lines for the purpose of producing a very fine fog-like spray of water. This spray is used for curing concrete products and is used with or without steam heat. Ordinarily the water pipe lines are erected overhead by attaching them to the roof or ceiling. The water must be clean and under pressure. There are great possibilities for the sale of these nozles in the concrete products field.

The plant of the Illinois-Wisconsin Concrete Pipe and Tile Co., Beloit, Wis., recently placed in operation. It represents modern ideas in handling raw materials and finished products and in this respect has features of special interest in the layout of the plant and in several items of its equipment.

The plant is near the pit site of the Atwood-Davis Sand & Gravel Co., whose main offices are in Chicago and which is in reality the parent company. Charles E. Richardson of the Portland Cement Association, is to a considerable extent responsible for the promotion of the new plant and for many details in its construction. The operation of the plant is under the management of G. B. Harker.

The raw material supply which is the basis of the enterprise is aggregate of a very high quality. Gondola cars from the pit are unloaded by a clamshell bucket operating from a locomotive crane. There are four main bins for the storage of aggregate in various sizes. Each of these bins is 10 ft. by 14 ft. by 24 ft. high. In the No. 1 bin is material passing ¼ in. screen; No. 2 bin material from ¼ in. to ⅜ in.; No. 3 bin from ⅜ to ¾ in., and No. 4 bin ¾ in. to 1⅛ in. A fifth bin is for the storage of coal.

These bins feed near the bottom onto a horizontal conveyor belt through hand controlled gates. The conveyor belt in turn feeds to an elevator which puts the material into auxiliary bins in the top of the plant.

Alex. M. Pringle, 627 Lexington Pl. N. E., Washington, D. C. manufacturers vases, flower boxes and garden furniture, using Ideal molds and Conlin granite chips for facing. Interested in Vibrating machine.

Geo. Lang, manager of the Cunard Lang Concrete Co., of Columbus, O., has one of the most efficient concrete block plants in the country. With seven men and a working foreman he is able to produce 2,500 or more blocks per day of 9 hours. Roughly speaking the efficiency of a concrete block plant can be measured in terms of block per man per day. Mr. Lang's plant grades over 300 block per man per day or 33⅓ block per man-hour. What does yours grade? Four block machines are used, two Anchors, and two Hobbs all with Anchor tampers. These are set in rectangular form each at one corner of a platform about 10 by 6 ft. in area and 3 ft. high. The overhead chute delivers the mixed concrete to the center of this platform and the machine operators hoe the concrete into the mold boxes.

Vermont Cement Brick Co., F. J. DeForge, Pres. Bellows Falls, Vt., have been compelled to move to larger quarters on account of the rapid growth in its business. In their new quarters the company is now prepared to handle its share of the expected increase in the products business both quickly and efficiently. The plant is equipped with modern up-to-date machines including a Helm press for making blocks and brick and a Kent Continuous mixer.

The Bellevue Silo Co., W. E. Simon, Mgr. Bellevue, Mich., wants prices and catalogs on molds for making chimney blocks, burial vaults, culverts, drain tile and fence posts.

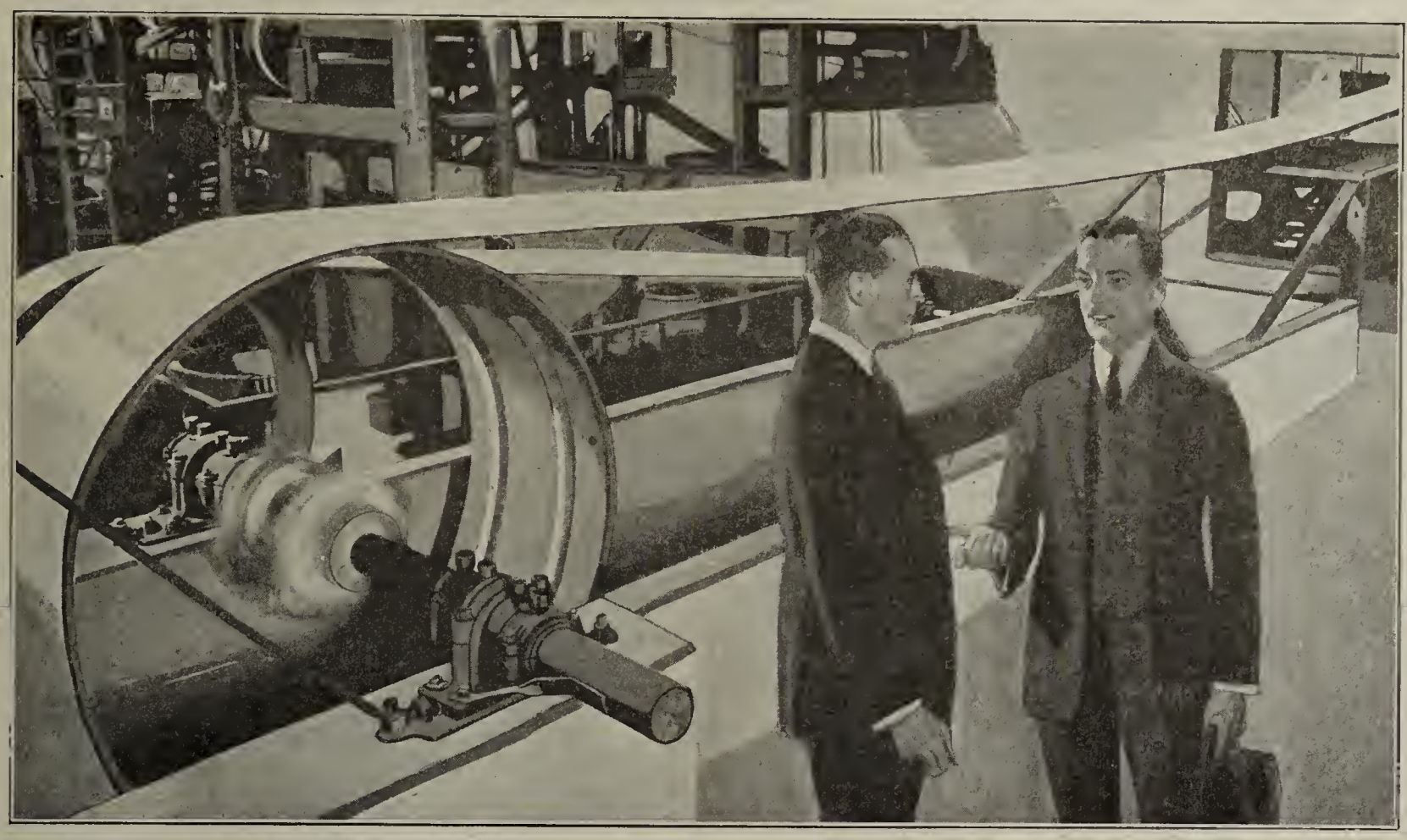
W. J. Barnhart, Guthrie, Okla., operates Hobbs and U. S. Standard block machines, Automatic Sealing burial vault molds and a Perfect brick machine. Is in the market for hand mixer, rigged for power; roofing tile machine, tamper, sewer pipe, vases and flower boxes molds. Wants prices on white cement.

R. S. Cade, Canton, Ohio, has purchased unit septic tank molds of Wm. DeLhorbe, Oregon, Ill. and expects to do a lively business in his section of the country.

Lacon, Ill, new industry, the La-Con-Crete Company, manufacturers of concrete building tile, shingles, floor tile, and a big line of fancy building material, bids fair to become one of the important industries of Marshall county. A number of orders have already been booked for the concrete roofing tile (made in molds furnished by L. Hansen & Co., 3617 E. 23rd St., Kansas City, Mo.), which are sure to become popular throughout the county. A Chicago architect visited the plant recently and was enthusiastic in his praise of the product being turned out, predicting that the company will enjoy a big business as soon as its goods become known. We congratulate Messrs. Grieves, Boers and Garrels, owners of the business, upon the success that is in prospect for them.

There are but few manufacturers of concrete machinery who operate concrete products plants in which can be demonstrated the equipment they have to sell. Such is the case with the Acme Tile Co., Passaic, N. J., which makes Acme concrete building tile and also Acme steel molds used in the manufacture of the poured concrete tile.

During the past year many interesting features have been developed by this company. The Acme tile, which is interlocking, was originally made in wooden molds, but the company, seeing the vast possibilities of this tile, did not wish to put it on the market until an all steel mold was perfected, which would simplify the manufacture of the tile and would also permit the tile to be put on the market at a cost which would be reduced to a minimum. The entire fall and winter of 1921 has been spent in improving and perfecting this mold, which the company is now ready to supply. The new mold is a 10-unit gang mold, equipped with polished steel face plates and sides, cast separators, roller bearing casters and a one-piece steel collapsible core.



What your money BUYS in "Commander"

—A belt that can carry the heaviest overloads

—A belt that is ingeniously cushioned to absorb shocks and strains

—A belt that is moisture-proof thru and thru

—A belt dampness cannot shrink or stretch; that freezing temperatures cannot stiffen—permanent pliability

—A belt from which all excess stretch has been removed

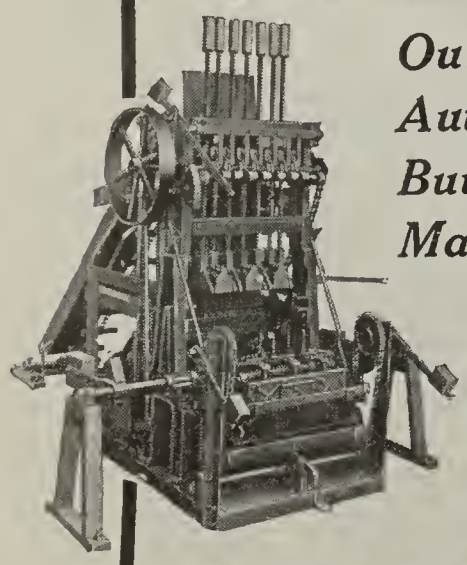
—A belt that is flexibility itself

—A belt free from ply separation

—A belt for heavy duty backed by the good name of Goodrich and assuring long, faithful and economical service. A cost cutter wherever it has been installed. For economy's sake, try it!

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

Goodrich
Commander
TRANSMISSION BELTS



Our Fully-Automatic Building Tile Machines

are strong, sturdy, speedy, and highly efficient. Deliver three tile on a single pallet, with no stopping or delay for offbearing of tile. *Investigate* today and you will *invest.*

If It's *Ideal* It's Dependable

IDEAL stands for dependability—our record of a fifth of a century, with pleased users throughout the world—is evidence of the quality and service of our products. An Ideal machine is an investment; install one of our Hand Block Machines with Tamper—let it work for you—and shortly you will require one of our fine Automatic Block Machines with Tamper.

The Ideal Concrete Machinery Co.

1338 Monmouth St. **Cincinnati, O.**

A clean-cut, graceful, strong, water proof burial vault that sells readily

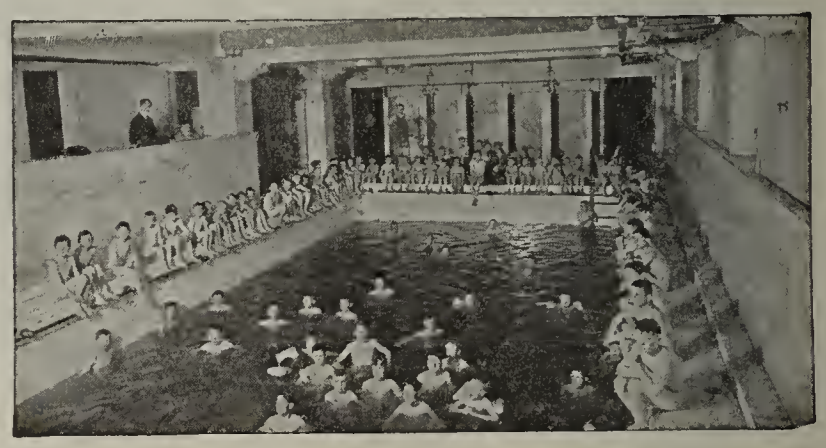
THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.

216 E. River St. **PERU, IND.**



Insured Against Leakage

Swimming pools can be made absolutely watertight and free from leakage for all time by adding 2% Medusa Waterproofing (powder or paste) to any standard portland cement lining.

Equally efficient when used to waterproof cement mortar for setting tile or marble lining.

The waterproofing forms on integral part of the whole concrete mass penetrating the pores and permanently sealing them against the seepage of moisture.

Ask for Medusa Cement and Waterproofing booklets.

THE SANDUSKY CEMENT CO.

Dept. E, Cleveland, Ohio

MEDUSA

WATERPROOFING *for* CONCRETE

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

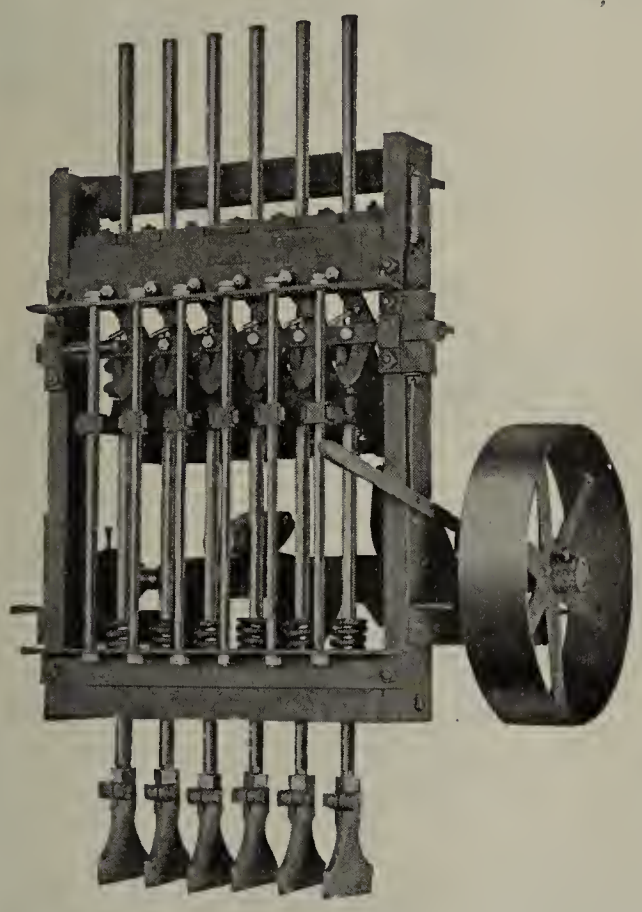
See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

The Ever Increasing Demand For Kent Tampers Reflects Public Preference For Its Unfailing Performance

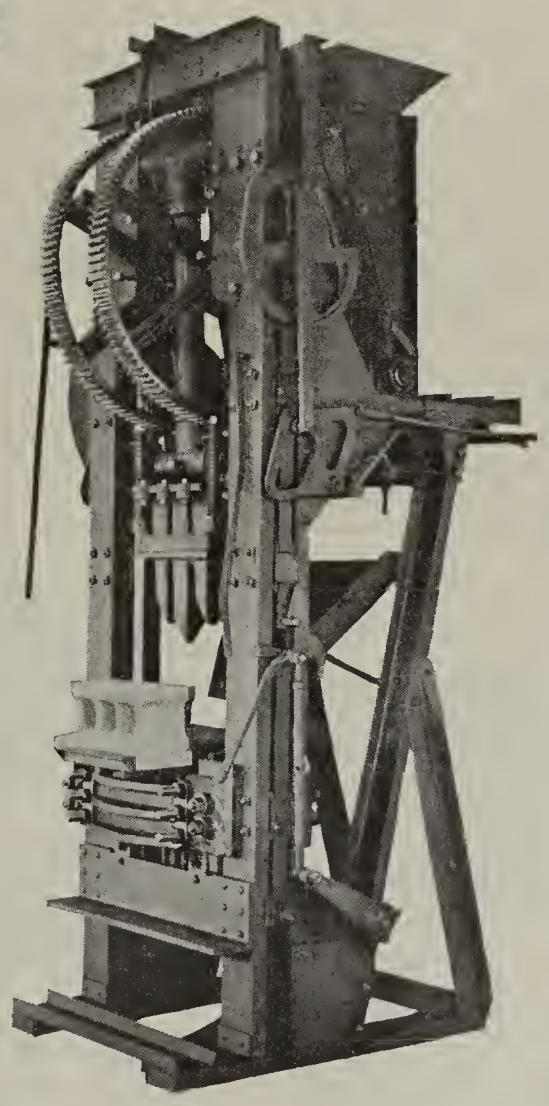


Experienced concrete products manufacturers know the value of owning a tamper in which every part is made by an old experienced organization of reliability—a tamper that is guaranteed and protected by the manufacturer.

The greatest proof of Kent performance is gained from statements of owners of these tampers, which are operated all over the country. Their story is convincing.

A tamper to be economical must be operated with the least amount of power and it must be so designed that the depreciation is minimized. Such economies are regulated by the correctness of mechanical design and Kent engineers have constantly kept pace with user's requirements.

Post Economy Punch Block Machine



for large production of quality concrete blocks. It is an automatic machine.

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block.

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operatoı.

The mighty force of the Post Economy Punch delivers such tremendous pressure upon the entrapped concrete that the resulting block is unusual in its strength and endurance.

That's the block you need to answer the demands of your territory—a fast seller, one that builds homes free from upkeep costs and builds satisfaction among your customers.

RED LINE PRODUCTS

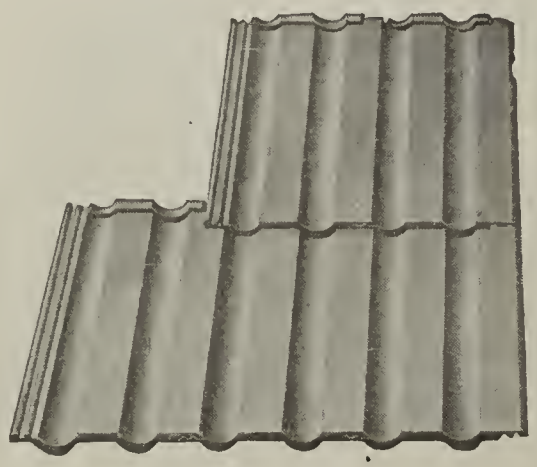
Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

CHICAGO OFFICE,
429 MONADNOCK BLK.

KENT, OHIO

YOU OUGHT TO INVESTIGATE THE SUCCESSFUL



FRENCH TILE

developments we have made in the concrete roofing tile manufacture in the way of absolutely PERMANENT COLORING and unique STRENGTH OF THE TILE, performed with our new coloring method and a peculiar pattern of the underside of the tile—specially designed for giving the tile the GREATEST STRENGTH IN ITSELF and for the purpose of REINFORCING THE TILE IF DESIRED.

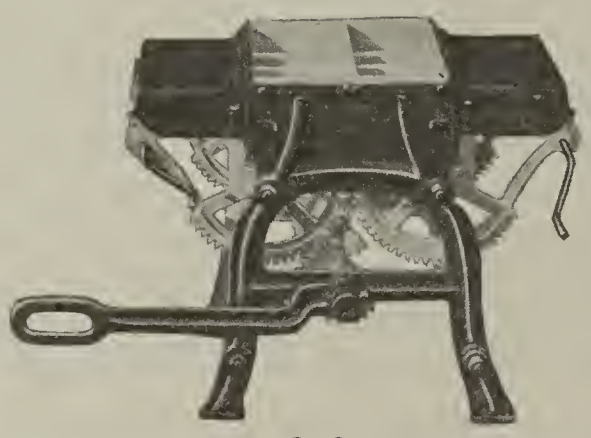
The service we give our customers is thorough and insures you of success when you are entering the concrete roof tile business—using our machines.

Write for the U. S. CHAMPION ROOF TILE BULLETIN

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.

SPANISH TILE



Double your daily output with

DOUBLE-SPEED

Brick and Block Machines

Now is the time to increase the capacity of your block plant—turn out the maximum number of wall feet per day, while the demand for building materials is at its highest.

Block Output

Our Double-Speed Block Machine makes in each operation: 2 hollow blocks, 2 silo blocks, 2 solid blocks, 2 slabs, 4 half blocks, 2 water table slabs, 2 return ends, 2 chimney blocks, or 2 porch pier blocks.

Brick Output

Double-Speed Brick Machine makes 16 brick at each operation, 8 brick being delivered at each side of the machine.

Double Speed Tamper

This power tamper gives our block machine a capacity of 1,500 blocks per day and speeds the brick machine up to 12,000 brick per day. Roller-cut-off removes surplus material from mold box and finishes the top of the product. The block and brick are tamped rapidly and vigorously, resulting in a dense, strong product. Machine consumes little power and is practically fool-proof.

Write for block and brick machinery catalog, Dept. A,

Wood Bros. Thresher Co. Des Moines, Ia.

THE HOBBS

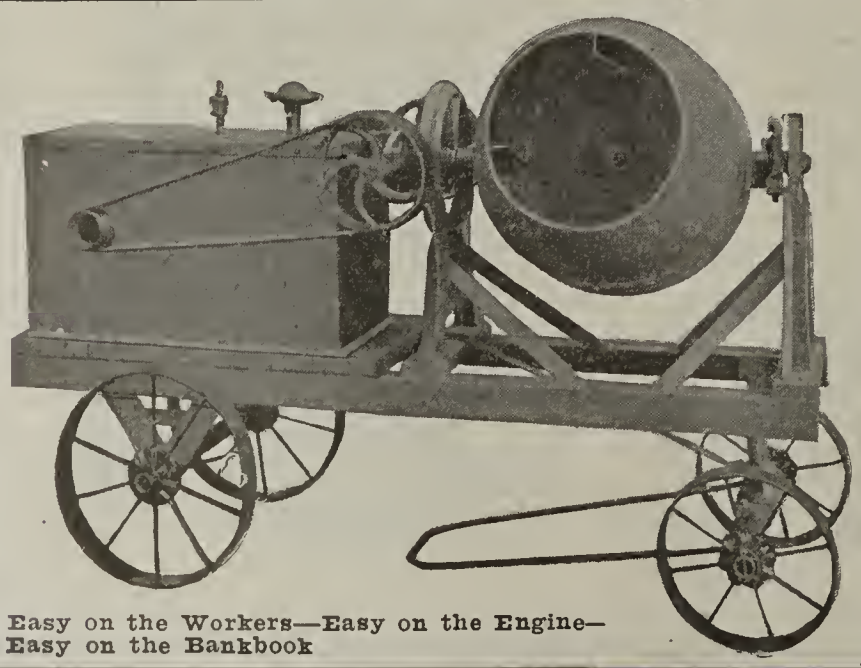
The multiple oval cores of a Hobbs machine make the use of wet mix possible with no loss of time. The result is a hard, dense, waterproof block—plain for foundations and cover walls—faced for superstructure.

For Catalogs and Prices, write

The Anchor Concrete Machinery Co.

Adrian, Mich.

Rock Rapids, Iowa; Columbus, Ohio.



Easy on the Workers—Easy on the Engine—
Easy on the Bankbook

Biggest Mixer Bargain Ever Offered

REMMEL MIXRITE Concrete Mixer

The World's Best 3½ Cubic Foot Mixer

All Iron and Steel construction with the EXCLUSIVE SIDE GEAR DRIVE, that adds 100% to its worth. Mixer loads or discharges from either side—always in gear when dumping. Strongly built—no wobbling.

The Popular Mixer for

MASON CONTRACTORS
Saves 50% in Labor

CONCRETE CONTRACTORS
Large enough for the average job and small enough to be readily moved. A Money Saver.

CARPENTER CONTRACTORS
Just the right size for foundations and floors.

TOWNSHIPSS
Just right for culvert and county work.

Sold Under Iron-Clad Guarantee. Write for complete specifications and descriptive circulars. Dealers wanted everywhere.

REMMEL MANUFACTURING CO.

Dept. E Kewaskum, Wis.

SHOPE
CONCRETE BRICKS
The Brick With a Personality

SHOPE BRICK CO
LET US PREPARE
PORTLAND THE CITY OF HOME
Showing Shope side faced waterproof 8 inch hollow wall construction

There are cement brick and there are SHOPE Concrete Brick. SHOPE Brick are different. There is no competition for manufacturers of SHOPE Brick.

Shope Brick sell on a quality basis. You don't have to cut prices to compete with any building material.

The matchless beauty, the wide variety of facings and colors and the sterling quality of Shope Concrete brick allows an unequalled selection for both interiors and exteriors. Soft, pleasing finishes, restful to the eye, or a brilliant color to relieve the somber of an appealing duller tint, combinations of all kinds are possible with Shope brick.

SHOPE Brick manufacturers have exclusive territories, protected by basic patents on machinery and process of manufacture.

Investigate the manufacturer of SHOPE Concrete brick. Learn just how our equipment works, what kind of a product it turns out, how fast it does its business and how little labor is needed in a SHOPE process plant. Find out how SHOPE engineers can assist in equipping your factory to manufacture a maximum output of products with the shortest possible pay roll.

Shope Brick Company

361 East Morrison Street **Portland, Oregon**

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

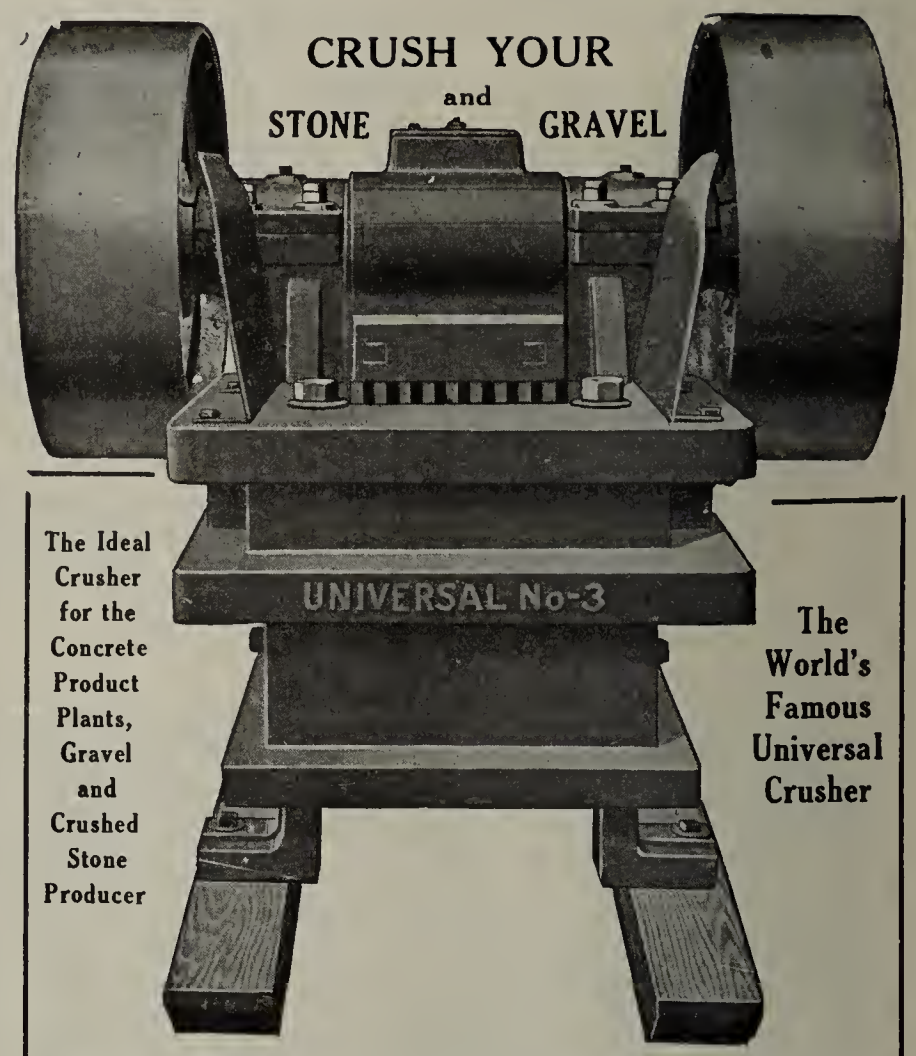
Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

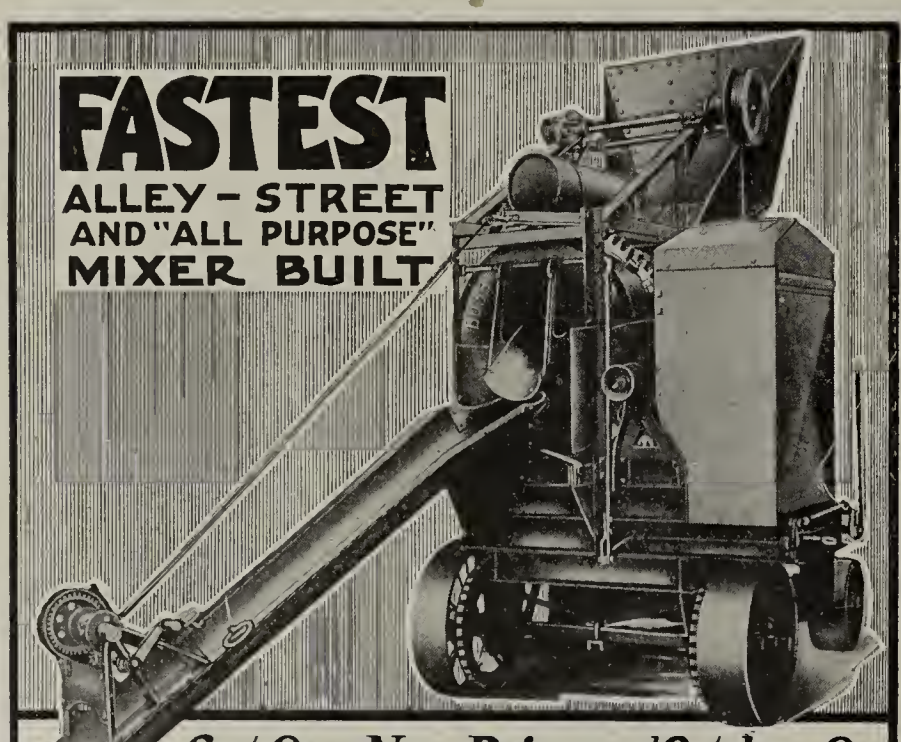
We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,

FASTEST ALLEY – STREET AND "ALL PURPOSE" MIXER BUILT



Get Our New Prices and Catalogs On Building and Paving Mixers (ALL SIZES) and Hoists

Write or Wire

The American Cement Machine Co. Inc.

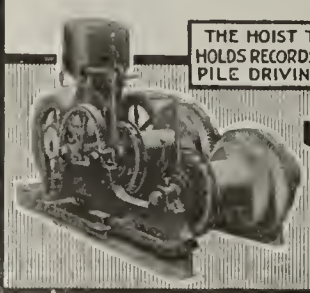
Branch Offices In All Principal Cities

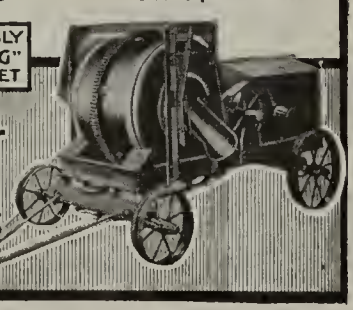
Keokuk Iowa
THE 300,000 H.P. ELECTRIC CITY

Prompt Deliveries From Stocks in Principal Cities

THE HOIST THAT HOLDS RECORDS FOR PILE DRIVING

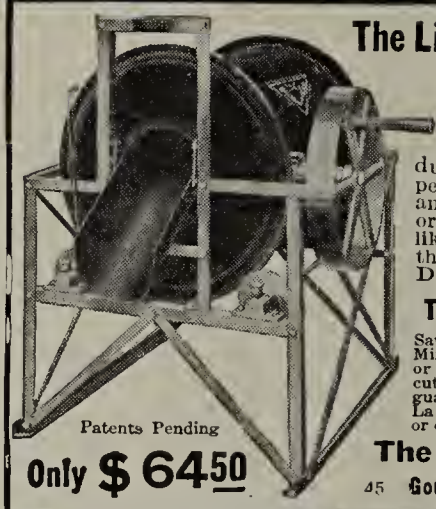
MOST REASONABLY PRICED "ONE BAG" MIXER ON MARKET





Used By Over 6,000 CONTRACTORS

ONE MAN CAN RUN IT



The Little Whirlwind Concrete Mixer
THE MASTER MIXER
From Factory to You—Save 40%

Only ***real practical*** small mixer producing same ***perfect*** work as most expensive big machine. Complete with hand and power drive. A ***winner*** for the contractor or cement worker. ***All steel and iron.*** Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forms, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delays.

Patents Pending

Only $ 64.50

The Little Whirlwind Mixer Co.
45 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

SAVE CEMENT

Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

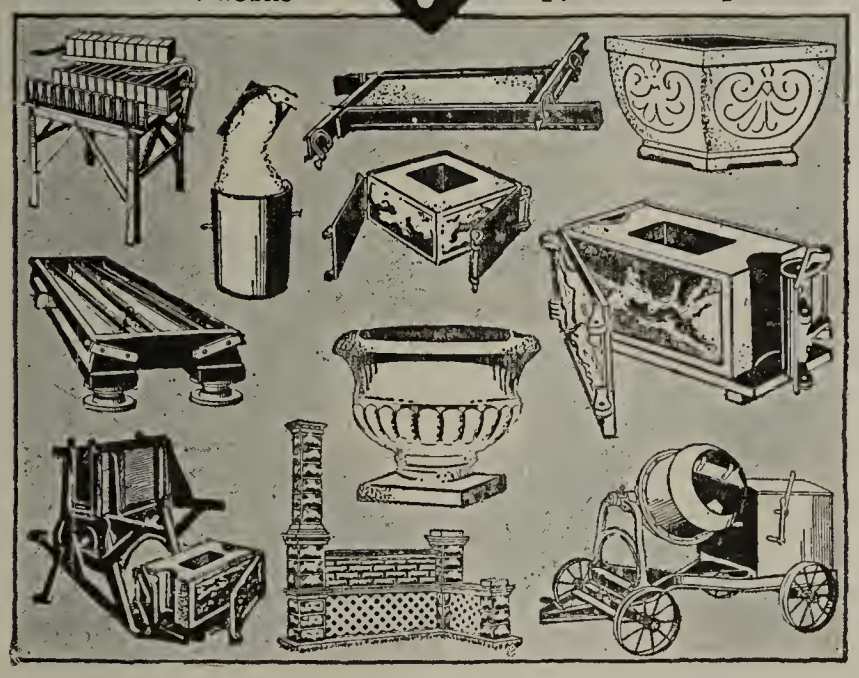
Write us for particulars.

Handy Sack Baler Co.
620 S. 2d St.,
Cedar Rapids, Iowa

Make More Money out of Concrete Work!

Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

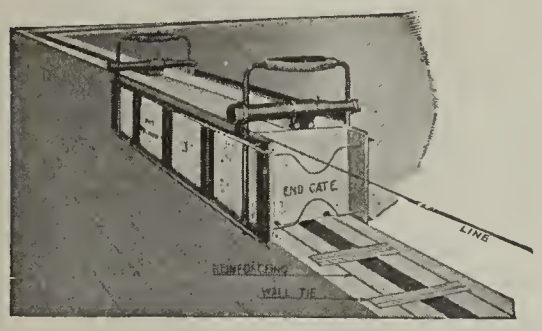
Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

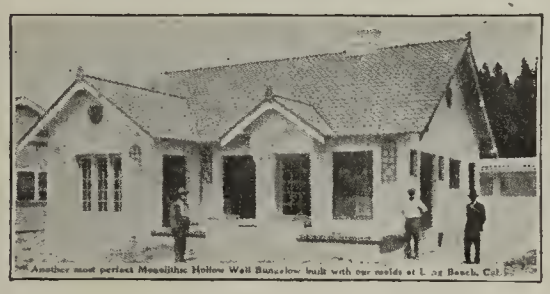


Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

For 50% Build the Hollow Wall Way For 50%




Another most perfect Monolithic Hollow Wall Bungalow built with our molds at Long Beach, Cal.

Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

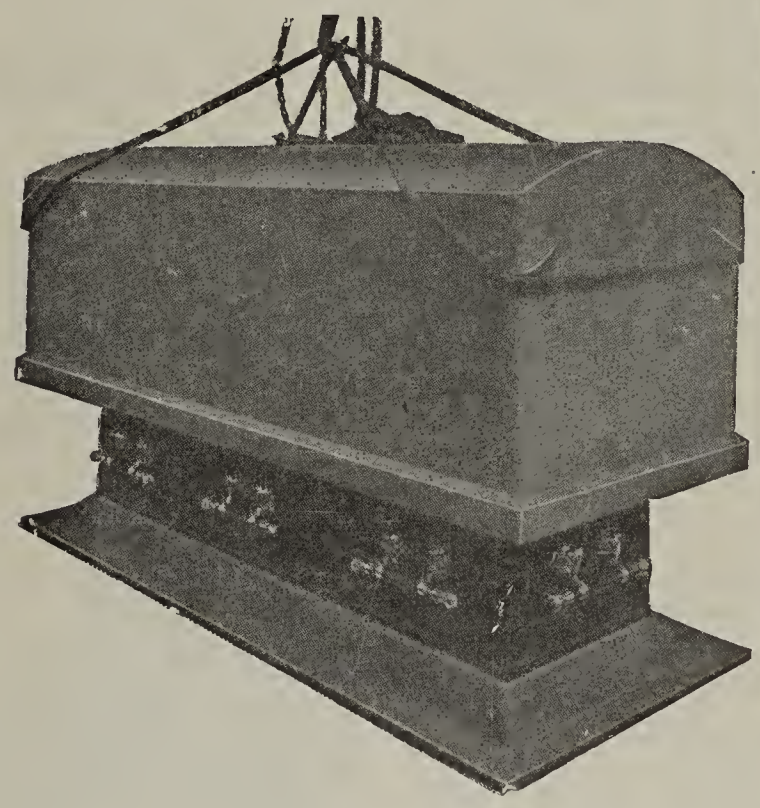
make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.



GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE" (Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples
VICTOR BALATA & TEXTILE BELTING CO.
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston
CONVEYOR BELTS A SPECIALTY

Illustration S-1086. *Sauerman "Excavator" type power scraper stripping trap-rock quarry; a good example of the digging power of this particular scraper.*

Illustration S-1063. *Sauerman "Crescent" Power Drag Scraper in conjunction with a compact 200 ton per day screening plant.*

Sauerman Power Scrapers—

As we have three distinct types of power scrapers — all bottomless and therefor self-dumping, but each differing in design and ranging from light to heavy construction—we are in a position to offer each prospective user a scraper system specifically adapted to the requirements of his particular work. Sauerman Power Scrapers do away with all hand labor and intermediate handling equipment, dig and convey in one operation, load and dump automatically, are extremely simple to maintain and operate, and have a flexible capacity to meet a varying demand.

A county engineer who has used a ½ cu. yd. Sauerman scraper two seasons writes: "The upkeep has been trifling and the output has heen limited only by the capacity of the screen to handle it and the ability of our fleet of trucks to take away." A contractor who is employing one of our scraper systems in working a gravel hank to furnish materials for a 10-mile road contract, states: "It is working into our plans very nicely and we have been able to do things with it that we could not have done had we not had it." A commercial sand and gravel producer who operates three plants equipped with Sauerman scrapers has just purchased another complete scraper system from us to be installed in a new plant that will be opened this spring.

Why not write us about that job of yours? Our suggestions may save you money,—and your request for information does not obligate you in anyway.

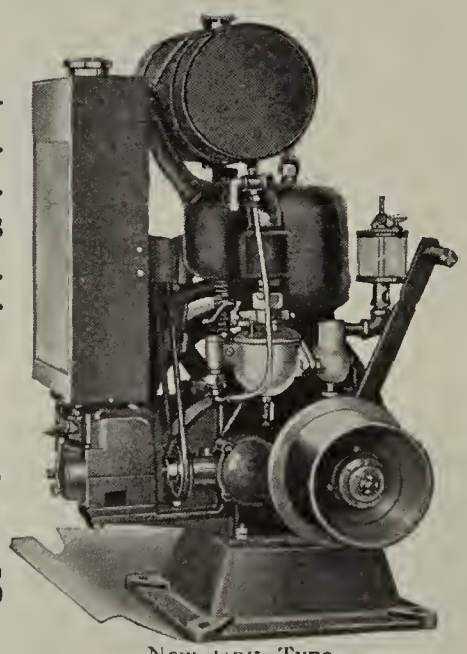
Sauerman Bros., 1139 Monadnock Bldg., Chicago

Your Machine Will Deliver Better Service With a

CUSHMAN

Light Weight Heavy Duty Engine

Over 50,000 in successful service. Sizes, 1½ to 20 H.P. Let our engineers work with you. Write us your power problem.



New Unit Type
4 H.P. CUSHMAN
Weight, complete, 230 lbs.

CUSHMAN MOTOR WORKS
821 N. 21st St.
Lincoln Neb.

NAYLOR *Lock-Seam* SPIRAL DREDGING PIPE

The greatest advance in the manufacture of spiral pipe. It is formed of one continuous strip of very tough Skelp Steel, and is made absolutely water and air tight without the aid of rivets or the use of pipe coating. Has double the life of any other.

If you are interested, we will be pleased to send you, at our expense, a small section of 12-inch, No. 10 gauge steel pipe; it will demonstrate to you the serviceability and economy of our Lock Seam construction.

ROBERTSON BROS. MFG. CO.
5401 So. Western Blvd. CHICAGO, ILL.

Cement and Engineering News

Vol. 34 Chicago, OCTOBER, 1922 No. 10

The 1923 Convention

The next convention of the American Concrete Institute will be held in Cincinnati, Ohio, Monday, Tuesday, Wednesday, and Thursday, January 22-25, inclusive, at the Hotel Sinton.

The place and approximate time of the convention were decided upon at a meeting of the Board of Direction in Cincinnati, May 12, the definite time has since been fixed.

At a meeting of the Board of Direction last February the Board authorized referring all existing standards of the Institute to their originating committees, or their successors for revision:

(1) As to **form** to make them conform to the Institute's newly adopted Standard Form of Standards, copies of which were mailed to the Institute's membership last fall.

(2) As to **substance** according to the best judgment of each committee.

The Institute's standards are in such shape in regard to inconsistencies one with another, and in the fact that they have in some cases become more or less inoperative for lack of revision in keeping with the industry's progress, that the beforementioned action of the Board was decided upon as the only means of putting the standards in such shape as would justify getting them but in separate prints in addition to making them available in future issues of our Proceedings.

The Board is particularly desirous that as much of this work be done in the present convention year as possible, and that the revised standards be returned by the committees to the Secretary in time for preprinting and submission to the Institute membership, with a view to their being passed upon at the next convention and referred to letter ballot.

As the next convention will be held earlier than in previous years (January 22 to 25 inclusive) and as the by-laws require that proposed standards shall be referred to members thirty days in advance of the convention, it will be necessary that standards proposed for submission to letter ballot by action of the next convention shall be in the Secretary's hands by November 20, next.

Concrete Garden Furniture

William Danmar of Jamaica, N. Y., is an artificial stone manufacturer who has made an unusual success with the manufacture of concrete garden furniture. He also makes a specialty of decorative stone work for use in mantels, fireplaces and exterior building trims.

Mr. Danmar markets his products under the trade name of "Danstone."

What Cement Is Doing to Help Reduce Fire Hazards

Fire losses in the United States in 1921 were more than half a billion dollars.

Fire loss adjustments made by insurance companies in the United States and Canada during the past fourteen years amounted to $3,410,752,600. The average yearly loss was $243,625,200. The loss for 1920 was $330,853,925.

Losses from fire in the United States average $3 per capita per year. France has a per capita loss of 49 cents; Great Britain, 33 cents; Germany, 28 cents, and Holland, 11 cents.

During the past fourteen-year period our fire losses were 28.1 per cent of the value of new building construction. In 1920, although an abnormal amount of building was done, the fire losses were 23.5 per cent of the value of new buildings.

Startling as these losses are, they do not tell the whole story. They represent only the actual insurance adjustments made. They do not take into account losses due to the fact that buildings are seldom insured for more than 80 per cent of their full value, nor do they include losses not covered by insurance. The insurance adjustments made probably do not exceed 70 per cent of actual fire losses, including both insured and uninsured.

The surest safeguard against loss by fire is a building so constructed it cannot burn.

Reinforced concrete represents the highest type of fire-resistive construction. Concrete is practically maintenance free. Concrete grows stronger as it grows older.

Concrete homes are protecting the American family from the dangers of fire.

Concrete apartments, hotels, office buildings and factories, house thousands of workers in our cities. In these, concrete has reduced the danger from fire to a minimum.

Concrete construction is a means of reducing fire insurance premiums.

If there is any building that should be made absolutely firesafe it is the schoolhouse.

In the United States a fire occurs every day in some school.

In a properly planned school building, in which concrete has been consistently used throughout, fires of dangerous proportions are practically impossible.

The Portland Cement Association is constantly cooperating with all established agencies concerned with the problems of fire prevention.

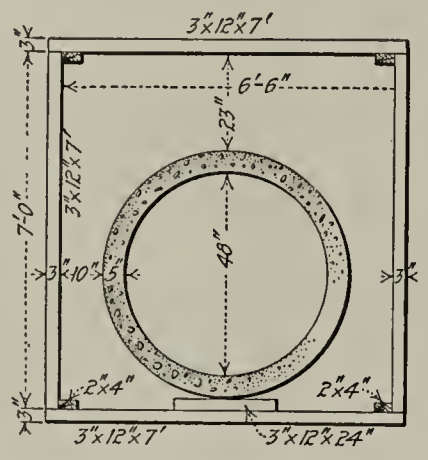
The Association has engineers who confer constantly with builders and architects with a view to eliminating fire hazards.

Concrete Pipe Line Augments Kansas City Water Supply

Pipe Made on Site Hauled by Crawler Tractor Over Soggy Soil and Placed in Tunnels with Home-Made Derrick Car—Water-tightness Tests

By Frank E. Miller, Assistant Engineer, Water Department, Kansas City, Mo.

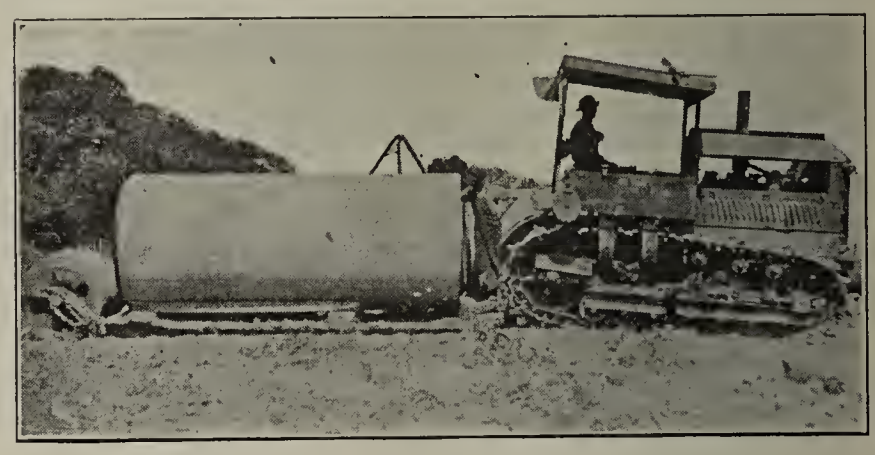
With the new 48-in. concrete gravity conduit between Quindaro and the Turkey Creek pucping stations of the Kansas City water departlent in operation the daily delivery of water to Turkey Creek has been increased about 10 m.g.d. This makes the maximum daily capacity of the works m.g.d., as the 48-in. steel main and 36-in. cast-iron mains together can carry 75 m.g.d. The new concrete line was put into regular service January 21. Two sections aggregating 1,800 ft. in length are laid in tunnel 15 to 30 ft. below the surface. The remainder of the 7,785 ft. of pipe is laid in open cut. The pipe lengths were made on the job, hauled over soft ground to place on a steel skid by crawler tractors and placed in the tunnels by a special car carrying a cantilever beam. Five tests for water-tightness were laid. The conduit is laid from Edgewater Junction to the east line of the water-works property at Quindaro along the south side of the Missouri Pacific right-of-way. At each end the concrete line was connected to 48-in. cast-iron mains on the opposite side of the tracks. A pipe-making plant was established midway of the length of the line adjoining the right-of-way. A stiff-leg derrick with 90-ft. steel boom was utilized for setting and removing forms, setting reinforcing, handling concrete and placing completed pipe in the store yard. A small horizontal boiler was used for operating the machine shop and for supplying steam for curing the pipe. The



Typical Tunnel Section, Kansas City Conduit

cast-iron rings forming the bell and spigot, furnished by local foundries, were machined at the pipe plant. The outside of the spigot ring was machined to a true circle, the front end forming a truncated cone. The inside of the bell ring was machined to a perfect circle with a groove machined into it to receive the lead gasket. These rings were set in place with the reinforcing bars. Each pipe was reinforced with ⅝-in. round rods—eight longitudinally and 34 circumferentially. The longitudinal rods were hooked into the bell-and-spigot rings and assembled on mandrels, after which they were set in place by the boom inside of the steel forms. The 1:1½:2½ concrete was mixed on the ground level by two ¼-yd. mixers operated by gasoline engines, and dumped into a chute whence it passed into a ½-yd. conical bucket handled to the forms by the boom. Each of the 648 pipes was 12 ft. long, had 5-in. walls and weighed 5½ tons when completed.

As the conduit is located along the toe of the bluffs adjoining the railroad right-of-way, all of the surface water from the hills flowed to this site and through culverts under the tracks, making it difficult to do any heavy hauling. The pipes were delivered over new roads with a 10-ton crawler tractor. A skid with a steel bottom, 4 ft. wide and 16 ft. long, at the end of



Hauling 48-in. Concrete Pipe on Steel Skid

which was a wheel 3 ft. wide and 24 in. in diameter, was used in moving the pipes. Loading was done by hand, after which the tractor was hooked to the skid. The tractor operated in the mud about as well as on hard dry soil. The use of wagons for hauling the pipe would have been almost impossible.

The 5,985 ft. of open ditch excavation was done by contract with the Halpin-Dwyer Construction Co., of Kansas City, under the supervision of Wm. D. Boyle. A trench 7½ ft. wide and from 7 to 12 ft. in depth was excavated by a steam shovel operating on skids over the center of the ditch. The excavated dirt was piled along the south side of the ditch and pulled back into the trench with a backfilling machine after the pipe was laid. It was necessary to brace most of the trench to prevent caving. The shovel excavated about 75 ft. of trench a day, just keeping ahead of the pipe-laying outfit.

Since the bottom of the trench, when excavated, was found to be a wet soggy soil with quicksand in some places, a mat was constructed the entire length consisting of two 4x6-in. stringers or sills onto which 3x12-in. x 7-ft. plank were spiked. This work was done by separate contract with the excavating contractor who placed the mat just ahead of the pipe layers to prevent any settlement.

Tunnel Excavation

Two tunnels were driven where the conduit was from 15 to 30 ft. below the surface of the ground. The first tunnel, 800 ft. long on a tangent, was driven from three working shafts 16 ft. long by 8 ft. wide and 400 ft. apart. The second tunnel was 1,000 ft. long and driven on a 1-deg. curve from four working shafts, 333 ft. apart. For lining the tunnels, 3x12-in. yellow pine planks 7 ft. long for top, bottom and sides were used. The bottom 3x12-in. plank was set in place first, then the top plank was set and held in place with a screw ditch-brace; the side planks were then set, driven to place and cleated at corners with 2x4-in. nailing strips. As each lineal foot was excavated, a set of the 3x12-in. lining plank was set. The excavated dirt was wheeled

to the shafts in wheelbarrows where it was hoisted to the surface with windlasses operated by hand. The inside dimensions of the tunnels when completed were 7 ft. high by 6½ ft. wide. Hand pumps handled the water which came from springs causing headings to cave. Extra bracing then had to be used to support the roof.

This work was done by the water department forces operating in two shifts, from 7 a. m. to 3 p. m. and from 3 p. m. to 11 p. m. It was necessary to employ three 8-hr. working shifts to complete the headings on the two center shifts. A working shift in each heading consisted of nine men: Two to excavate and brace, one to load wheelbarrows, two to wheel out excavated dirt, two on the windlass and two wheelers on top to handle excavated dirt.

The pipes were rolled by hand onto skids over the ditch where they were picked up with a derrick mounted on wagon wheels spanning the ditch and set in place. The joint was made up by placing a lead gasket in the machined groove in the bell ring. The spigot end was entered and pulled to place with a clamp fastened to the last pipe laid and to a bar across the end of the pipe being laid. This operation caused a tight pull forcing the spigot end in tight against the lead gasket in the bell ring. The joint was completed by troweling a 1:1 mortar of cement and sand into the joint inside and outside of the pipe.

In the tunnels the pipe was handled with a four-wheel car operated on light rails by a gasoline engine and a niggerhead. A 12x12-in. timber 20 ft. long was rigged up on the car making a cantilever boom 8 ft. of which projected ahead of the car, which was 20 ft. long. The pipes were lowered into the tunnels through the working shafts, where they were picked up with the boom. By entering the boom about half way into a pipe length and tightening a chain block on the other end of the boom the pipes were lifted off the floor of the tunnel and suspended on the end of the boom. The back end of the car was loaded with sacks of sand to counterbalance the load and to prevent the car from tilting. A 4-hp. gasoline engine mounted on the car with a niggerhead pulled the car and pipe to place in the tunnel for laying, which was done in about the same manner as in the open trench. The car was pulled back to the shaft again with the niggerhead ready to pick up another pipe, which was lowered after the car was back past the shaft. This method was employed in laying all pipes in the tunnels and was found to be very satisfactory. After the pipes were laid in the tunnels and in the open trench on the mat, concrete was placed under them, extending about 12 in. each side of the center line. This was done to overcome the knife-edge pressure on the bottom and firmly to set the pipes on the mat and give them a uniform bearing.

The tunnels were back-filled with earth after the pipe laying was completed by excavating shafts 50 ft. apart on the center line, 3 ft. square and down through the roof of tunnel. The dirt was placed in the shafts with teams and slips. In the tunnels it was pulled to blace by hand.

At the Edgewater crossing the tracks were timbered and the pipes were laid in an open trench about 10 ft. deep. At the Quindaro end a tunnel 75 ft. long was driven under the tracks and filled with concrete after the pipe had been laid. Two 48-in. valves were set on the cast-iron line near the ends of the concrete pipe. Four 24-in. manholes with 3-in. air valves in the top of the plates and two 12-in. drains were placed in the line.

The concrete main was designed to withstand a working head of 100 ft. and a guarantee was submitted by the contractors, the Lock Joint Pipe Co., that the completed pipe line, upon being put in service, would not leak to exceed 0.4 cu. ft. per lineal foot of completed line in 24 hr., which is equivalent to 16.15 gal. per minute for the entire 7,785 feet.

The conduit was filled with water December 24, four days after completion, and allowed to stand for about two weeks when tests for leakage were made at the east end of the line through a 2-in. pipe. A 5-in. double-acting plunger pump, operated by a 4-hp. gasoline engine, was used to raise the pressure on the concrete conduit, the 48-in. valves at the ends of the line being closed. The water going into the conduit was measured with meters which were tested before being used. The pressure gage used was also tested and corrected. The manhole plate on the highest point on the line, 8.7 ft. above the lowest point on the line, was removed and allowed to remain open during one night to detect any leakage there might be through the valves at the ends of the line; they were found to be tight.

The results of the leakage tests are summarized as follows:

Date, 1921	Pressure, Lb. per Sq. In.	Lgth. of Test, Hr.	Total Leakage Gal. per Min.	Remarks
Jan. 5	36 to 39	3½	51.57	
Jan. 6	37 to 41	3	46.30	About normal pressure
Jan. 7	15	24	14.38	
Jan. 10	30	4	22.73	
Jan. 21	30	6	21.63	After 10 days in service

After the test of January 21 the line was again put in service. Three leaks appeared on the surface over different parts of the line but they have since taken up and stopped. From the present observation on the surface the line is not leaking.

The work was done by the Board of Fire and Water Commissioners of which G. W. Humphry is president. The design and construction was carried out under the general direction of W. B. Goodwin, superintendent, and C. S. Foreman, first assistant engineer. The writer was resident engineer in charge of construction. The Lock Joint Pipe Co. was represented by J. C. Mitchell, general manager, and W. W. Trickey, superintendent.

Non-Freezing Explosive

The Atlas Powder Company, Philadelphia, Pa., has succeeded in producing a non-freezing explosive, the qualities of which are such a distinctive type, that it is bound to be welcomed eagerly by all blasting operators and especially by those who do cold weather blasting.

Briefly, the qualifications of Atlas Non-Freezing may be stated as follows: (1) Five grades for every blasting requirement; (2) Cannot freeze at any temperature; (3) Withstands the heat of summer; (4) Its stability avoids premature explosions (nothing weaker than a No. 6 Blasting Cap should be used to detonate it); (5) Will not cause headaches to those who use and handle it; (6) Made in all standard size cartridges.

Alumina Cement—Its Development, Use and Manufacture

This is a history of and properties of high strength, quick setting cement being produced commercially in France. The article was prepared for the "Engineering-News Record" by Henry S. Spackman, a Philadelphia consulting engineer

This paper gives, in digest form, definite information relative to the alumina cements now commencing to be generally used in France. These cements are differentiated from portland cements by their chemical composition and by the fact that both in mortars and concretes they develop strength at the 48-hr. period equal to or exceeding that developed by portland cement at 28 days. In addition, alumina cements show a markedly greater resistance to the attacks of sea water and water-carrying sulphates in solution.

Early Study

Almost 20 years ago it occurred to the writer that it might be possible to produce a better and more uniform cement than portland, and possibly a cheaper one, by the mechanical admixture of the separately prepared compounds then considered its essential components. With this object in view, the writer, at first in collaboration with Dr. E. W. Lazell and subsequently with E. L. Conwell, had made and studied the various silicates, aluminates and ferrates of lime then thought to be essentially present in portland cement together with a number of possible variants of these compounds, among which were aluminates of lime in proportions corresponding to two and three molecules of alumina to one of lime.

The purpose in making these various low lime aluminates was to ascertain the minimum amount of lime necessary to make the alumina active and cause it, on being added to lime, either in the form of oxide or hydrate, to combine with it. Briefly summarized, the conclusions drawn in relation to aluminates from this investigation which covered a period of over 10 years were:

Cements resembling portland cement in their action could be made from mechanical admixtures but that these cements did not develop strengths comparable with the strengths developed by low lime calcium aluminates;

Where the lime present in the aluminates exceeded that required to form a mono-calcic aluminate, the aluminate was usually too quick setting for practical use as a cement;

Where the lime present approximated that required to form mono-calcic aluminates they could be made either slow or quick setting by varying the hardness of burning. The lighter burned aluminates were quick setting and the harder burned, slow setting;

When the lime present was less than that required to form mono-calcic aluminate, the aluminate was slow setting;

The quick setting mono- and di-calcic aluminates could be made slow setting by the mechanical admixture of slow setting low lime aluminates;

Both the slow settin low lime aluminates and the slow setting mechanical mixtures of the quick setting and slow setting aluminates were slow setting but very quick hardening and developed strengths greatly in excess of portland cement, especially at short time periods. The 24-hour tests showed strengths exceeding those of portland cement at 28 days and that the lime content in the aluminates could be reduced as low as three molecules of alumina to one of lime without apparently affecting the cementing value of the product.

Other sesqui-oxides could be substituted for alumina and that the presence of sesqui-oxide of iron up to 10 per cent seemed beneficial;

The presence of silica in any considerable proportions tended to reduce the early strength of aluminates, probably through replacement of the alumina content to which the high early strength was attributed;

The cementing values and soundness of aluminates were apparently unaffected by wide variation in the ratio of the lime to acid acting elements provided the lime was not present in excess of that required to form mono-calcic aluminates;

These alumina cements were strongly resistant to dilute acids and unaffected by sea water. The very low lime aluminates interposed greater resistance to attack by acid solutions than the higher lime ones.

It was also found that these aluminates, in addition, had the property of combining with hydrated lime and that their addition gave to lime mortars quick hardening properties and plasticity and that relatively small additions of these aluminates greatly increased the early strength and natural and puzzolanic cements.

Attempts at Development

As the purpose of the research was strictly commercial, no attempt was made to obtain even relatively pure materials but on the contrary low grade bauxites that could be cheaply secured in the market were used.

The equipment of the laboratory did not permit of such research work as was subsequently carried out by Day and Sheppard, Rankin, Bates and others, consequently no attempt was made to determine the chemical compounds formed in the various aluminates produced.

During the first years of the investigation, the aluminates were produced in the laboratory either by calcination in a small kiln 12 in. in diameter and 3 ft. high, or were fused in graphite crucibles heated in a gas-fired reverberatory furnace. Subsequently aluminates were produced on a semi-commercial scale in a kiln 3 ft. in diameter and 10 ft. high. Both kilns were operated continuously. The raw material after being ground, moistened, and molded into small bricks and dried, was fed into the kiln with the fuel and the calcined material drawn from the bottom. In all, some 20 tons of slow setting, quick hardening alumina cement was manufactured.

In 1909 the Aluminate Patents Co. was formed for the commercial development of the patents granted the writer, but as his patents covering the alumina cements had been held up by interference proceedings between his application and M. Bied's, which interference was subsequently decided in the writer's favor, and as the use of alumina cements as an addition material to lime seemed the most promising of immediate financial return, no effort was made to place the low lime alumina cements on the market nor was any description of them published at that time.

As the aluminates made from mixtures of lime and bauxite in the manner described were very expensive, there was substituted for them a high alumina slag produced by the Pennsylvania Steel Co. from the smelting of the Mayari ores of Cuba, which gave slags low in silica and having an alumina content of about

30 per cent. While this slag in itself was an inert material, it could be made by special treatment sufficiently active to combine with lime and serve as an additional material. The writer regrets that his test of the high alumina cements were confined to tensile and compression tests of the cements either neat or 1:3 sand mortar. His explanation for this omission is that the importance of concrete tests was not recognized at the time.

As a result of Bied's laboratory investigations, J. & A. Pavin Lafarge commenced about 1912 to place fused mono-calcic aluminate cements on the market under the trade name of "Cement Fondu." The outbreak of the war stopped the commercial development of these cements, but their manufacture was continued for military use.

Corroborating Investigation

P. H. Bates of the Bureau of Standards (see Technologic Paper 197) has recently reported results of a very extended study of aluminates undertaken by the Bureau of Standards under his direction. This research included the microscopic determination of the compounds formed both by the calcination and hydration of the aluminates as well as physical tests of neat, mortar, and concrete specimens made from eight different lots of alumina cements of varying compositions produced by calcination in the rotary kiln.

His conclusions in general correspond with those of Bied and the writer. He found that the higher lime aluminates were quick setting, that the lower lime aluminates were slow setting, and that the hydration of the lower lime aluminates consisted in the formation of hydro-calcic aluminate and hydrous alumina. He found that the low lime aluminates gave high strength at short periods, the rapid hardening being due to the rapidity with which the aluminates hydrated and the high strengths due to the thoroughness of the hydration and the large amount of colloids formed, but that owing to the susceptibility of these colloids to moisture changes the alumina cements would not be satisfactory for use when subject to the action of water.

Laboratory Conclusions

The work of these three independent investigators demonstrates beyond all possible question the fact that slow setting, quick hardening cements can be produced by the calcination of mixtures of alumina and lime in which the ratio of available lime to alumina does not exceed the mono-calcic proportion; that the cement so produced gives strengths, neat in cement mortars, and in concretes at the end of 24 and 48 hours as high or higher than the strengths ordinarily developed by portland cement at 7 and 28 days and that the strengths of low lime high alumina cements continue to gain up to the three-month period. So far the conclusions drawn from their work are in complete accord. Mr. Bates also states "that the methods of storage of the test pieces showed that these cements had their strengths rather materially reduced by the absorption of moisture. This was due to the large amount of colloidal products of hydration which are very susceptible to moisture changes. They would therefore not be satisfactory for use when subjected to the action of water." This action noted by Mr. Bates is not in accord with the experiences of M. Bied and the writer in their laboratory work nor with the results obtained by actual use in work in France of such cements extending through a period of over 10 years.

This difference on so vital a point is unfortunate and it is to be hoped that continuance of the tests and further analysis of the resuls will lead Mr. Bates to a modification of his conclusions which, however, applies only to the particular cements made by the Bureau of Standards tested under the methods employed.

Present Use in France

With the end of the war, high alumina cements were again placed on the French market. At present two firms are engaged in their manufacture and sale, J. & A. Pavin Lafarge and the Bureau D'Organization Economique. When the writer was last at the works of Lafarge in 1919, alumina cements were being produced in a small furnace, the coke, limestone and bauxite being fed into the furnace without preliminary fine grinding. The molten material was drawn from the furnace in the same manner as slag from an ordinary blast furnace. The iron oxides contained in the raw material, owing to the reducing action of the furnace and difference in specific gravity, partially separated out from the slag as metallic iron, but not sufficiently to affect the color. All commercial alumina cements are much darker in color than portland cement. If bauxite low in iron is used, a white cement can be produced. This company is now constructing a second plant at Moutiers, Savoie, France, where the electric furnace will be used. The alumina cement produced by the Bureau D'Organization Economique is fused in an electric furnace, hence its trade name, "Cement Electric."

Properties of French Cement

In a recent letter, the Bureau D'Organization Economique makes the following claims for "Cement Electric":

Th cement is a mono-calcic aluminate containing a fixed quantity of silica and oxide of iron and is made by the grinding of a product produced by the fusion in an electric furnace of a predetermined mixture of silica, alumina, iron and lime. The finished product is a mono-calcic aluminate containing certain quantities of silica and oxides of iron.

The cement is slow setting and is gaged like the ordinary portland cements but is distinguished from them by the altogether special qualities that it hardens rapidly and gives high strengths at early periods and is indecomposable by selenious waters and sea water. It is used in the same manner as portland cement but hardens more rapidly.

It is no exaggeration to say that at the end of 24 hours its strength equals that of portland cement at the end of a month, therefore forms may be removed from walls after 24 hours and from girders and slabs after 48 hours. Concretes mixed 1 part cement, 1 part sand, and 3 parts gravel show compressive strengths of 7,500 lbs. per square inch at the end of 3 days, 8,500 lbs. at the end of 28 days and 9,000 lbs. at the end of 3 months and continue to show slowly increasing strength with time. Concretes mixed in the proportions of 1 cement, 1½ sand, and 3 gravel, give strengths of 5,750 lbs. at 2 days, 6,000 lbs. at 7 days, 7,500 lbs. at 28 days and 7,750 lbs. at 3 months. Therefore, in making calculations for structures, the compression members may be figured at 2,000 lbs. per square inch instead of at 700 lbs. generally used for portland cement. This results in a marked diminution in the section of compression members which together with the saving in form lumber, offsets the higher price of the cement.

The writer has no recent figures covering the strengths developed by the "Cement Fondu" but from information obtained in 1919, he believes there is little or no difference in the strengths developed by the two cements.

Owing to the higher price, the use of alumina cements in France to date has been confined to work where the special qualities are more important than price, such as repairs of streets and pavements, floors of factories, urgent alterations, foundations for machinery, etc., and in work exposed to water carrying injurious solutions and to special construction of which the following are typical examples:

Structural Uses

In the construction of a large coal storage depot for the Compagnie du Nord it was found that the foundations must be carried through a thick layer of quicksand and sunk to about 25 ft. The quickest and most economical method of sinking the foundation was by the use of caissons. This method was adopted, but with this novelty, the caissons which were constructed of alumina cement were also the outside foundation walls. The largest of these had exterior dimensions of about 85 ft. in length and 25 ft. in width with a height of about 25 ft. This caisson, in addition to serving as a foundation for the coal storage bins mentioned, was to be used as a room for the installation of power plant and coal handling machinery. Sinking the caisson, which was loaded with 225 tons in addition to its own weight, was started immediately after pouring. By reason of the unequal resistance of the soil during the descent, this caisson at times was very apparently deformed but never cracked or fissured and after being finally set in place there was absolutely no permanent deformation.

To Remodel a Five-Story Building

In another case it was desired to remodel a five-story building, the three upper floors of which were occupied as apartments and the two lower floors as offices of a bank. The work involved the removal of a maze of small rooms, the walls of which, as is customary in France, were masonry and carried the upper sories so as to form the large halls and offices of a modern bank. This reconstruction had to be done without interruption to the work of the employes in the bank in the two lower floors and without inconvenience in any way to the occupants of the three upper floors. Steel beams and columns could not be used as it would be impossible to put them in place without interfering with the occupancy of the building. Ordinary reinforced concrete was also objectionable as it would have required leaving the forms and supports in place for two or three weeks. It was, therefore, decided to use concrete of alumina cement. This was found very satisfactory as the forms and supports could be removed within 48 hours. In addition, a considerable saving in cost resulted as compared with portland cement through the use of smaller sections, a reduced quantity of form lumber and time required for the work.

Commercial Possibilities

As made in the laboratories of Bates and the writer, the manufacture of alumina cement differed in no way from the customary processes employed in the manufacture of portland cement and any portland cement mill could produce alumina cements from a mixture of bauxite and lime without change of machinery.

Omitting the price paid for the bauxite, the cost of manufacture, provided the aluminates did not materially reduce the production of the kiln through excessive ringing up, should be no greater than for portland cement. Theoretically it should be somewhat less as, owing to the low lime content and consequent reduced loss on ignition, a less quantity of raw material would have to be handled and in addition there should be some saving in the fuel required.

Dry Process Not Economical

The use of the dry process, however, in connection with so high priced a raw material as mixture of bauxite and lime, would not be economical owing to the dust losses and these should be minimized by the use of the wet process. It is probable that this dust loss together with the tendency to ringing up in the kilns of the lime-bauxite mix, was what induced the Bureau D'Organization Economique to adopt the electric furnace, for in 1919 M. Bied told the writer that as a result of his discussion with him in 1917 he had repeated his experimental work and found that fusion of the alumina cement was not necessary. Therefore, in the design of the new plant he expected to use the rotary kilns.

At present cost of fuel in France there is no marked economy in the use of the electric furnace, for while the number of kilowatt hours required to fuse a ton of cement is relatively low, this economy is offset by the high consumption of electrodes the cost of which offsets any fuel economy due to the use of hydro-electric power.

The increased cost of alumina cements produced in this country over portland cement will therefore depend on the price paid for bauxite. Assuming from $12 to $15 a ton for bauxite delivered at the works, this increased cost would amount to from $1.50 to $2 per barrel which should permit of the alumina cements being manufactured and sold at about $4.25 per barrel f.o.b. works, exclusive of package, which price corresponds to that at which it is now being sold in France. If, however, there was substituted for the better grade bauxite suitable for chemical work, bauxites high in iron, or there was substituted for part of the bauxite high alumina slags such as those produced by the Pennsylvania Steel Co. where the alumina content ran from 28 to 32 per cent and the lime from 28 to 30 per cent, or some other waste material high in alumina, a very marked saving should be made in the costs of these cements. Furthermore, the cost of the high grade bauxites would be much lower for mills located near the deposits as the price of bauxite used was f.o.b. Philadelphia.

While at first thought the use of a cement costing two or three times that of portland cement would seem prohibitive, the saving in time and form lumber will to some extent offset this and still further saving would be made, if as claimed by the French, a material reduction in section can also be made and still give a stronger structure.

Crushed Stone Company Utilizes Screenings

The Elmhurst-Chicago Stone Co. producers of crushed stone, Elmhurst, Ill. utilize all their screenings by operating a concrete building block plant which takes the screenings and makes them into high class building units. There is a demand for all the blocks that they can make, now that the building of homes is again revived. They make from 500 to 800 blocks a day, using Ideal block machines and Ideal automatic tampers, and the blocks are cured with live steam. The building in which their block department is located was once a brick kiln and its walls are 2 ft. thick, but this extra protection they find very handly in winter, when the block department is usually operated at capacity.

A Labor Saver for Handling Bulk Material

Fredonia Portland Cement Company Operates Unique Reclaiming Equipment

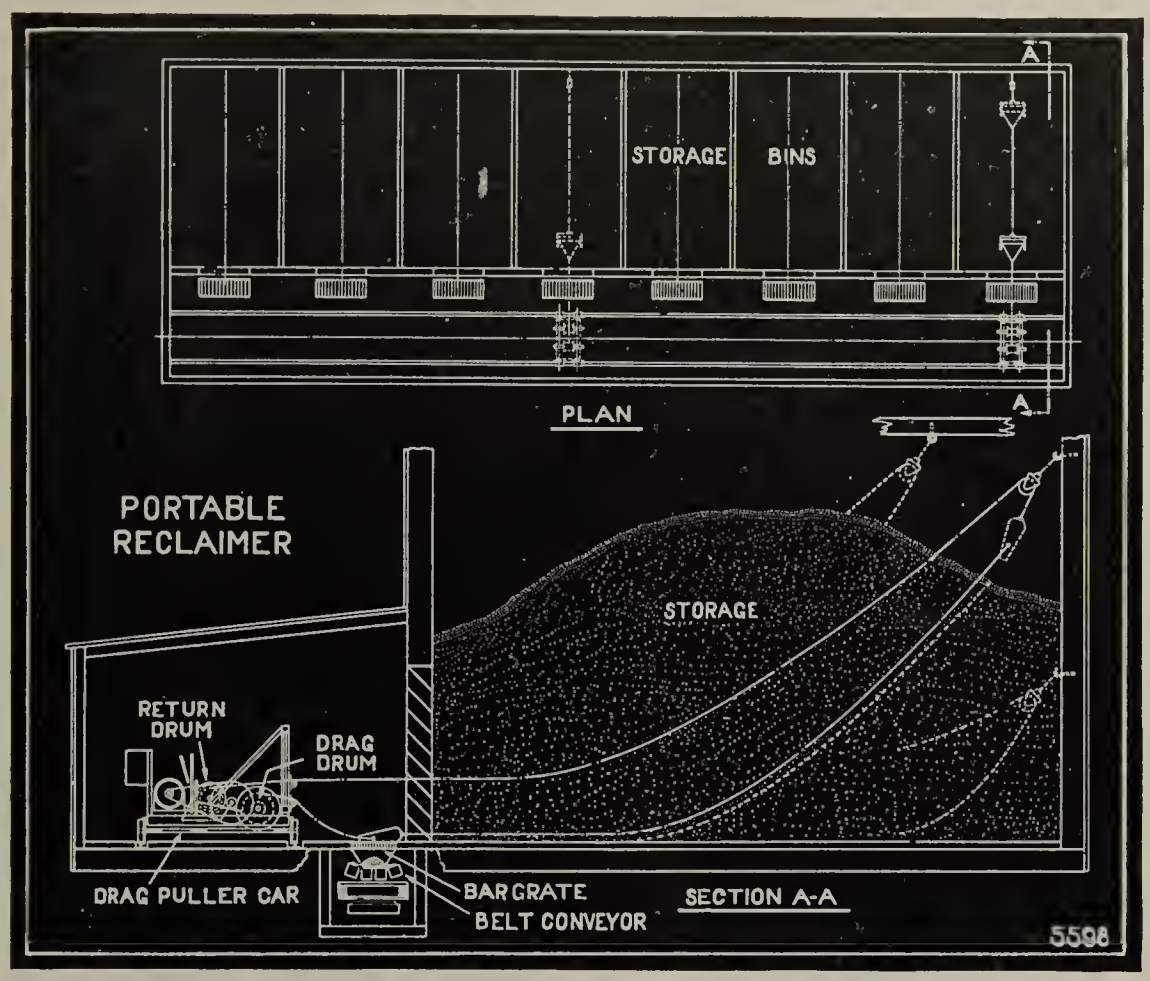
The storage of bulk cement has in many cases necessitated the erection of large storage bins which are particularly costly due to the design necessary for the storing of this material. These large storage bunkers from which the material is reclaimed through gates are quite generally of special design, which is made necessary through the somewhat peculiar mechanical properties of bulk cement.

In the storage problem at the Fredonia Portland Cement Company, the president, Mr. F. H. Patterson, devised a plan whereby the bulk material could be stored in a series of low inexpensive bins. While the problem of distributing the material to these bins was comparatively simple, the proposition of reclaiming from the bins required considerable study. A careful study of the requirements resulted in the design of a unique reclaiming equipment consisting of a portable motor driven double drum hauling machine for the operation of a small steel drag scoop mounted on wire rope cable, with the necessary movable sheave blocks and attarchment hooks.

The drawing which accompanies this article shows the location of the machine with reference to the storage bins and also indicates the manner in which the machine can be shifted from one place to another and spotted in front of any particular bin from which it is desired to withdraw material. In moving the machine from one bin to another, it is only necessary to detach the small sheave block, shifting the machine to another location, and again fastening the sheave block in place at the rear of the storage bin. Permanent fastenings for this purpose may be located in several different positions in each one of the bins.

The openings to the front of the bins are closed with louvre doors which can be opened partially, one at a time, for drawing the material from the bin to the hopper by gravity. These louvre openings can be controlled according to the position of the pile and the louvres may be removed, allowing the adjacent cement to flow out by gravity to the hopper, after which the power scoop is used to draw out the balance of the material from the bin.

The operator engages one of the winding drums, pulling the scoop back toward the rear of the storage bin. The next procedure is to engage the second winding drum which operates in the reverse direction, drawing the scoop toward the machine to a point just outside the front wall of the storage bin. At this point the material drops through a bar grating into a small hopper which loads the cement onto a belt conveyor or into a screw conveyor,



Quick Work on a Winter Job

Sixty Grain Tanks, 96 Feet High, Built in 65 Days

By James Stewart Company

Just 65 days after concreting was started, the construction of 60 reinforced concrete grain tanks 96 ft. 6 in. high was completed by the James Stewart Co. for the Western Maryland Railroad, which is one of the chief carriers of grain to the Port of Baltimore.

Six years ago the Western Maryland constructed at Port Covington, Baltimore, a 1,000,000-bushel elevator for the storage and handling of grain from railroad cars to ocean vessels. The following year the elevator's capacity was increased another 1,000,000 bushels. In 1921 the James Stewart Co. was awarded the contract for a 1,750,000 bushels additional storage, an addition to the working house where the grain is received, two-thirds larger, as well as extending the loading gallery 300 ft. When all this is completed, the Western Maryland will be able to load at one time three of the largest types (12,000 to 15,000 tons) of grain-carrying vessels or four of the smaller types (5000 to 7000 tons).

This increase of the storage capacity by 1,750,000 bushels, which means the construction of 54 large reinforced concrete tanks having a 20-ft. 6-in. inside diameter and 96 ft. 6 in. high, 32 smaller bins, made by the intersections of the larger bins, as well as the enlargement of the workhouse and loading galleries before mentioned, will cost approximately $700,000.

The first equipment arrived on the job Sept. 15 1921. The plant was set up and concreting was started on Oct. 1, and 65 days later, on Dec. 5, grain was placed in all the tanks of Annex 3, or a battery of 36 of the large tanks and 24 of the smaller. For this set of tanks, 11,891 cu. yd. of 1-2-4 concrete were placed, as well as 361 tons of reinforcing steel. For practically half of the 65 days, 3 shifts were worked. The balance of the time one 8-hour shift handled the job. One shift consisted of 2 carpenters on forms, 50 laborers and 3 hoisting engineers.

The foundation consists of a concrete slab or mat, 2 ft. 8 in. thick, reinforced, under all the tanks. A basement is constructed on this foundation which houses the conveyors, etc. The basement roof consists of girders, supported on columns, roofed over with a 12-in. reinforced slab which forms the floor of the bins above. On this floor was placed the movable forms for all of the 36 large and 24 small tanks. These forms were built solid and were 4 ft. in height. By means of 284 specially designed screw jacks, the forms were raised continually from the time the first concrete was poured until the tanks reached their final height of 96 ft. 6 in. A 6-in. slab was then placed over the top, which forms the roof for the outer portion of the tanks. A reinforced concrete building 9 ft. high, built with stationary forms, occupies the remainder of the roof and accommodates conveyor belts for distributing the grain to the various tanks.

The methods used to raise the forms are shown in the series of three photographs at the top of page 6 Two of these views were taken on Nov. 14, 1921, when the tanks were approximately 90 ft. high. The floor shown in the right-hand view is a working platform for wheeling and placing concrete which is raised together with the forms. The wall forms are below the working platform and are raised by jacks working on 1-in. steel rods, which are set in the concrete and which are continuous from floor to roof, being spliced

General Arrangement of the Concreting Plant. The Sand and Gravel are Unloaded from Boats at the left

with pipe thimbles. These rods carry the weight of the forms and the working platform. The jacks are attached to steel yokes, which are, in turn, bolted to the segments of the wall forms. As before mentioned, all the wall forms are built in one piece and raised together as a single unit.

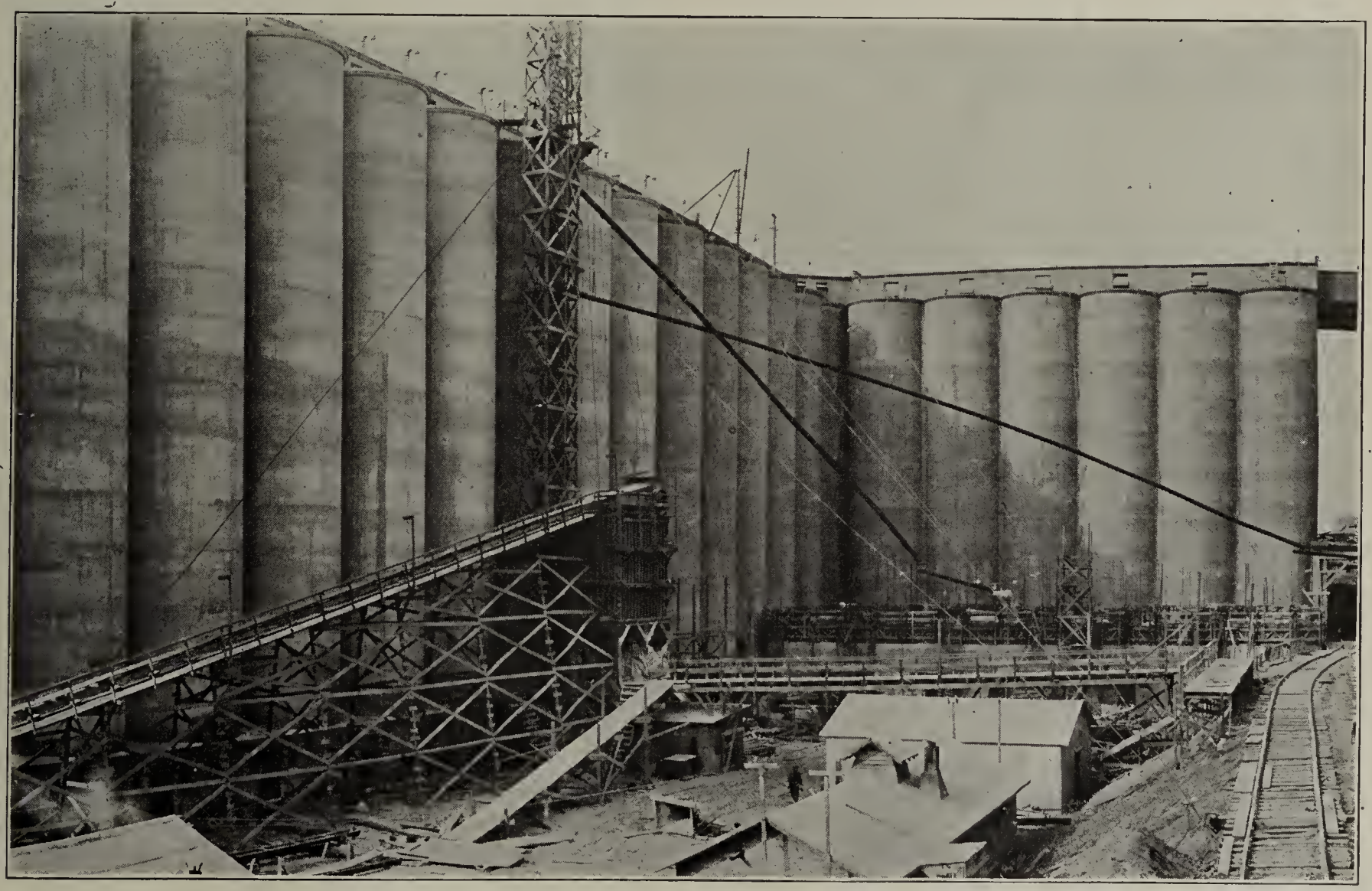
The walls are 7 in. thick, and horizontal reinforcing varies from 8 to 12 in. centers. The only vertical reinforcing are the 1-in. jack rods on approximately 8-ft. centers, there being about 8 jacks used per tank. The progress made when the shifts were working continuously averaged about 6 ft. 6 in. each 24 hours. The left-hand view shows the movable forms placed on the bin bottom ready for concreting on Oct. 21, 1921. In considering the speed, which is remarkagle, account must be taken of the fact that when the tanks reached an elevation of 15 ft. it was necessary to discontinue pouring of walls to place the hopper bottoms in all the tanks. This consisted of a cone-shaped fill of lean concrete (½ barrel to 1 yd.). This fill was placed at a slope of 9 in. on 12 in. to cause the bins to clear themselves when emptying. For the placing of this lean concrete, amounting in all to 3000 yd., one week was required.

Sand and gravel were brought to the job by scows and unloaded by a derrick operating a clamshell bucket into a receiving hopper. From this hopper material was conveyed on a 24-in. smooth belt, a distance of 225 ft. to the top of the charging bins, which have a capacity of 55 yd. of gravel and 25 yd. of sand. The charging hopper discharges into a proportioner or batch box beneath, in which the proper amount of material is placed. By means of a lever, this batch box dumps direct into a ½-yd. mixer. The batch box or proportioning hopper consists of a box holding 12 cu. ft. of gravel and 6 cu. ft. of sand, and has a drop bottom which is released by a small hand lever operated by one man, who also fills the batch box from the bins above. The drop bottom is arranged with a counterweight which closes it instantly after the discharge of the batch.

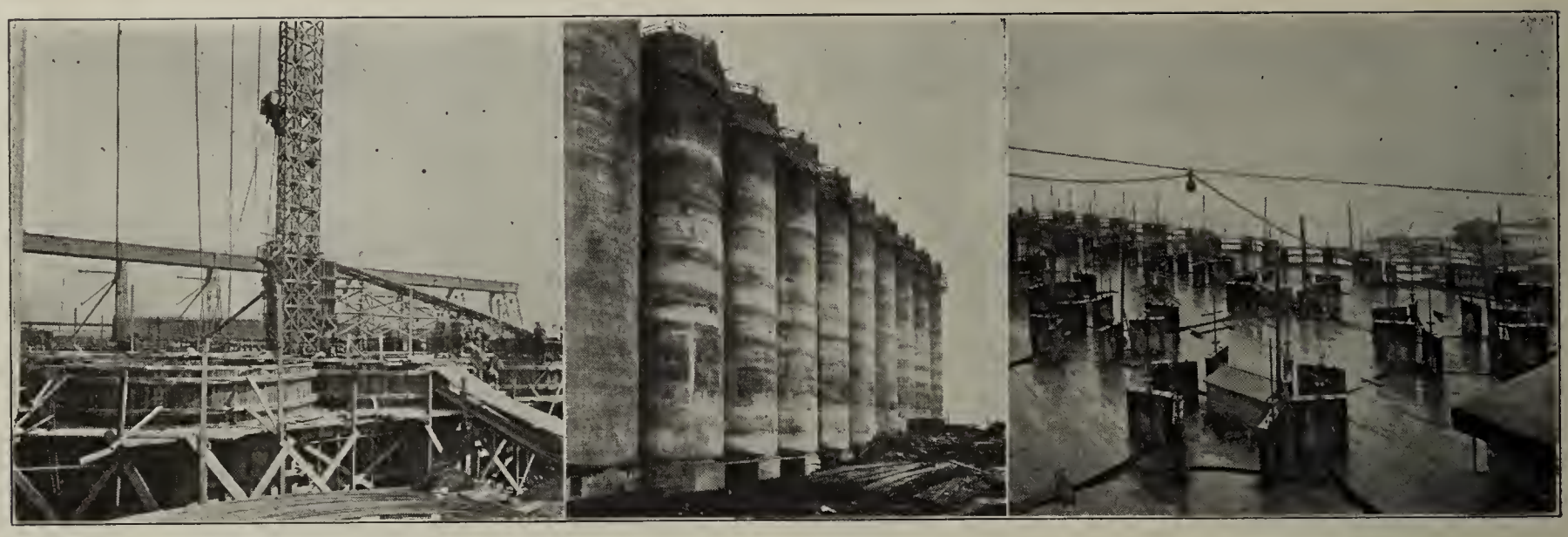
Cement was unloaded directly from cars by freight trucks and wheeled to the mixer platform over a runway slightly pitched from car to mixer. One man was able to wheel 8 to 10 sacks of cement at a load. No storage or secondary handling of any kind was done, and, although at one time as many as 3 cars of cement were used in 24 hours, no demurrage on cars occurred. A double 180-ft. wooden tower, one side used for elevating concrete, and the other for a ladder stairway to allow workmen to reach the working platform of bins, was located so that it might be used in connection with the construction of the remaining tanks and workhouse. The two photographs at the bottom of pages 4 and 5 show the arrangement of the plant.

For the first tanks, concrete was elevated and spouted to a floor hopper, from which the concrete was wheeled to place by buggies. For the remainder of the work an auxiliary tower will be built which will re-elevate concrete received by spouts from the main mixing plant. The enlarging of the workhouse, a concrete structure 180 ft. high, which contains all the elevating, weighing and cleaning machinery for taking care of the various grades of grain, is being started. This building will contain square storage bins for the first hundred feet, starting 20 ft. above the floor. Above this point it is known as the cupola, which is the ordinary beam or girder type of construction. At the present time Annex 3, before described, is completed. The bin walls for Annex 4, which consist of storage tanks, are up 6 ft. 6 in. and the foundation piles are being driven for the workhouse as well as the gallery extension.

To guard against explosions caused by dust, a



The Conveyor from the Waterside, Chuting Tower, and Arrangements for Unloading the Cement from Railroad Cars are shown in this half of the photograph



Oct. 21, 1921 Nov. 14, 1921 Nov. 14, 1921

sweeping system is being installed which covers the entire plant, with outlets on all floors approximately 50 ft. apart. By this system dust is picked up by suction caused by fans and conveyed through 18-in. galvanized pipes to a dust house, from which it is loaded on cars and shipped away, later to be used in the manufacture of stock food. At the ends and junctions of all conveyor belts, a sheet iron hood is placed over the pulleys, so that all dust which leaves the grain is automatically removed.

The entire plant was designed and is being built by the grain elevator department of the Stewart organization, of which W. R. Sinks is manager. Work will be completed in the summer of 1922. P. C. Metz is superintendent for the contractors.

New York Offices Dodge Mfg. Co.

The Dodge Sales and Engineering Company, Mishawaka, Indiana, manufacturers of power transmission appliances and heavy oil engines announce the removal of their New York City branch from 21 Murray street to the new Dodge building, located at the corner of Park place, W. Broadway and Murray streets, and known as 53 Park place.

The new Dodge building is twelve stories high and is of steel and concrete construction and is modern in every detail. The exterior is of terra cotta up to the second floor and the upper portion is faced with light brown brick ornamented with terra cotta panels. The entrance and lobby are imposingly finished in marble and bronze. Four elevators are installed in the building and special provision has been made for extra heavy floor loads which permits of ample provision for the storing of emergency trade service stocks as well as display of power, transmission machinery and heavy oil engines.

The Dodge Manufacturing Company have maintained a branch and warehouse in New York for over twenty-eight years and in moving to their new building conveniently located to shipping and railway facilities they will be able to handle more efficiently their large local and export business.

The Kent Junior Batch Mixer

The Kent Junior Batch Mixer manufactured by the Kent Machine Company, Kent, Ohio, has a very substantial truck and frame, designed to stand not only the use which a concrete mixer receives, but also the abuse which is oftentimes heaped upon a machine of this character by those engaged in contracting work. The axles are large and securely attached to the frame, the wheels having 3-inch wide tires, with gauge to suit that of the standard wagon. The frame itself is made of heavy steel channels, thoroughly braced crosswise and diagonally by heavy angles and bars and is rigidly fastened at the corners. The machine is 8½ feet long and 5½ feet wide over all.

The drum is made of heavy steel plates with iron heads and the mixing blades or scoops on the inside of the drum are fastened to the drum in such a way that replacement of broken and worn parts may be easily made with only the ordinary wrench as a tool.

The drum itself is carried on four solid trunion wheels, the surfaces of which have been chilled and which revolve in bearings of substantial design which are fitted with bronze bushings. This enables replacements of worn parts to be made by the purchase of simply a small bushing.

The sprockets and chain used in transmitting the power from the engine to the intermediate shaft and from the intermediate shaft to the drum are heavy in design and are made for long wear. The chain gives a flexible connection between the engine and the drums so that neither vibration, misalignment or wear can affect it.

The price of this mixer will interest you—due to the special facilities and unusual manufacturing advantages of the Kent Machine Company.

Bullseye Shovel

Bulletin C-201 of the Bucyrus Co., South Milwaukee, Wis., describes the company's 20-B Bullseye shovel, giving its exclusive and outstanding features, beginning at the boom end of the shovel. Included in these features are the two-part hoist, the all steel box type boom, outside dipper sticks, double hinged latch lever, horizontal main engine swing machinery mounted in front, removable propelling shaft, etc.

Rice County, Minn., Finds a Solution to Its Road Problems in Concrete

By J. C. McElherne, County Highway Engineer,
Faribault, Minn.

The rapid increase of motor vehicle traffic during the past 15 years, created for the Board of County Commissioners of Rice County the hopeless problem of maintaining at great expense a gravel road along the route now followed by State Trunk Highway No. 1. This road was in the past a beautiful graveled drive, but heavy traffic has worn out the surfacing and made travel over it at ordinary speeds difficult and unpleasant. The road is included in the Babcock Good Road Plan as enacted by the Minnesota Constitutional Amendment No. 1. This amendment provides that the state shall construct and forever maintain all the trunk highways and shall refund to the counties all money expended by them on such highways for permanent improvements subsequent to February 1, 1919.

From Faribault, the most southerly gateway to Minnesota's 10,000 lakes, Trunk Highway No. 1 carries the concentrated traffic of the Jefferson Highway, the Red Ball Route and the Glacial and Oak Dale Trails. A local traffic census counted 1,500 cars per day and during the tourist season traffic runs as high as 2,000 to 2,500 cars.

The Faribault-Northfield Road was built of concrete after a careful inspection of all types

Rice County decided in 1919 to take advantage of both the Townsend federal road bill and the Minnesota Constitutional Amendment No. 1, and issued bonds for permanent improvement of all main roads throughout the county. Surveys were made, plans prepared and bids received on all types of paving for the improvement of Trunk Highway No. 1 from Faribault to Northfield. After careful consideration, including inspection of existing pavements of the different types, the commissioners decided to use concrete and awarded the contract to Siems, Helmers and Schaffner of Saint Paul for the construction of 12.9 miles of 18-foot, one-course 7½-inch reinforced concrete pavement.

Work was started August 29, 1919, and in spite of the extraordinary labor conditions of 1920, very little time was lost on that account. The road was graded to a 30-foot width, and all curves super-elevated and widened according to the lune method. From a large quarry close at hand, crushed limestone was delivered to a central plant where batches of portland cement, Randolph sand and limestone were proportioned and delivered to the mixer by dinkies hauling 16 batches to a train. The paving project was completed June 28, 1921, at a total cost of $457,643.

During the period of construction a system of lateral roads was also graded and graveled. At the fall election of 1920, Amendment No. 1 was passed,

In spite of extraordinary labor conditions the Rice County work was rushed through on schedule.

thereby assuring the people of refund for all money expended on trunk highways.

While Rice County points with pride to the fine concrete road as the center of its comprehensive highway system, the real reason for our partiality for this material lies in the fact that it offered the only permanent solution of the maintenance problem and gave

Material was delivered to the mixer by Plymouth Gasoline Locomotives, hauling 16 Batches to a train

us a farm-to-market road passable at all times, and a tourist route drawing people 25 to 50 miles out of their way just to ride on the pavement, which leaves a lasting impression of prosperity on the thousands of visitors, who annually motor to the beautiful lake region of northern Minnesota. It is not likely that they will soon forget the roads of Rice County.

Suggestions for the Installation and Operation of Dredging Pumps

The function of a dredging pump is to create a rapid flow of water mixed with material through the pump and through the pipe line. The more rapid this flow, the greater the amount of solid material and the larger and heavier the pieces which can be carried with the water in suspension.

The only type of pump which can be used for pumping water containing solid matter is the centrifugal pump, on account of its absence of valves, and a dredging pump is simply a centrifugal pump designed with large passageways and designed also to resist wear.

The prime requisites in a dredging pump are, therefore:

First—It should have sufficient capacity and develop sufficient head to produce a rapid flow in the pipe line.

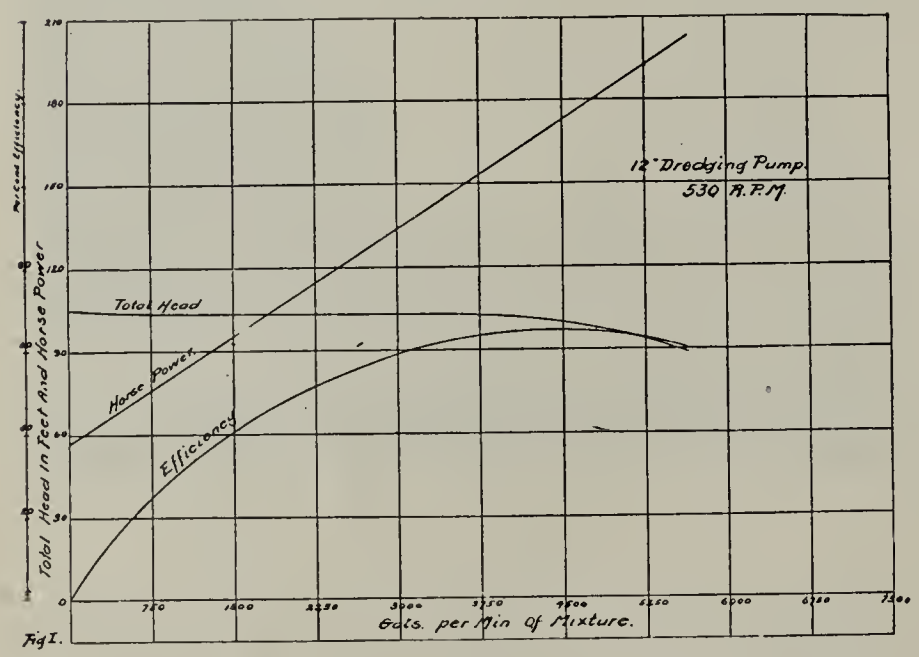


Fig I.

Second—It should have sufficient clearances to pass through the largest diameter pieces which it is proposed to pump.

Third—It should be designed to withstand the wear and abrasion caused by the mixture of gritty material and water.

Any pump fulfilling these requirements is bound to prove satisfactory, provided it is properly installed and the other conditions are right for its use.

The factors affecting the immediate design and selection of a dredging pump are as follows:

First—The nature of the material to be pumped.

Second—The capacity desired in cubic yards per hour, or the capacity in gallons per minute of discharge.

Third—The total head against which the pump is to operate.

Fourth—The speed at which the pump is to be operated.

Fifth—The amount of power required.

In considering No. 1, that is, the material itself, regard should be given to its nature, the sizes in which it occurs, its hardness and its sharpness. It is assumed in connection with this that the material is loose or means have been provided for loosening it up so that it can be picked up readily by the suction force of the pump. The nature of the material, its hardness, sharpness, and the sizes in which it occurs, have important bearing on the wear which the pump will be subjected to, the wear being the greatest with coarse, hard, sharp gravel. The sizes in which the material occurs determine also the necessary clearances through the pump. It may not always be practical to provide for the maximum sizes, and in that case decision must be made as to what are the largest pieces it is desired to pump.

Considering No. 2, that is, the capacity or output in cubic yards per hour, it should be remembered that this is dependent on the capacity of the pump in gallons per minute of water, on the per cent of solids which can be carried in suspension, and on the proportion of the time that the pump will be in actual operation. The capacity of the pump in gallons per minute is determined by its size and the pumps are usually rated for a velocity of 12 feet per second through the discharge, that is, the capacity of a 12-inch pump is the flow through a 12-inch pipe at the rate of 12 feet per second, or 4,200 gallons per minute This rating is rather arbitrary and can be varied considerably either way. The per cent of solids which can be carried in suspension is dependent upon the material itself, how uniformly it is fed to the pump, and also upon the velocity of flow in the pipe. When pumping light material such as mud or fine sand, much higher percentage can be carried than when pumping gravel, and under favorable conditions as high as 40 and 50 per cent has been realized. Under average conditions it is usual to figure on about 10 per cent solids. The uniformity of the feed depends upon the arrangement of the rigging for the handling of the suction, and also on the layout of the cuts. To secure best results with the plain suction type of dredge, the rigging must be such that the suction can be readily raised or lowered and moved to either side as desired, and the cut in the bank should be wide and deep, to permit the material to cave in. The percentage is also dependent upon the velocity of flow in the pipe line, being greater for higher velocities. As the friction losses in the pipe line and the amount of power required increase very rapidly with an increase in velocity, it is not economical to employ a greater velocity than 12 or 15 feet per second. For average conditions it is usual to figure on about 12 feet per second. When pumping fine sand or mud, 9 feet per second has proven satisfactory. In pumping heavy gravel a velocity of about 15 feet per second should be used.

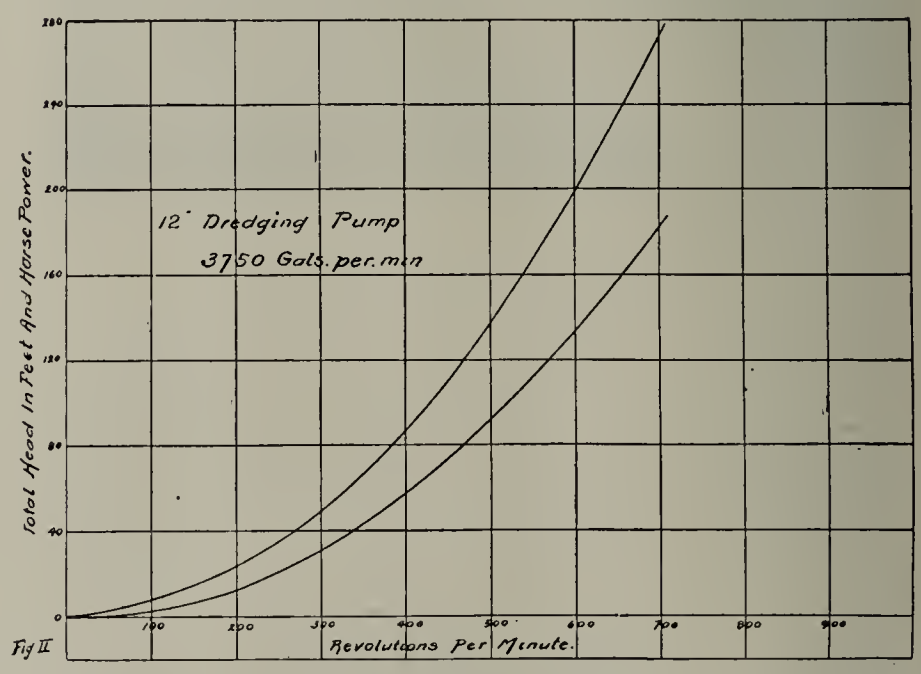


Fig II

Considering the interruptions in operation, it has been found from experience that the pump is shut

down from 20 to 40 per cent of the time, from various causes, either at the pump or in other parts of the installation. For average conditions, the actual operaing time should be figured at about 75 per cent of the total.

From the above considerations, when figuring on a daily output for average conditions the capacity should be taken at 10 per cent solids for a velocity of 12 feet per second through the discharging line, and for 75 per cent of the total possible working time. Thus the capacity of a 12-inch pump which at 12 feet per second and 10 per cent solids is 125 cubic yards per hour, can be figured at about 950 cubic yards per 10-hour day.

Considering next No. 3, that is, the total head against which the pump is to operate, this is found to consist of the static head or the actual lift, the friction head, or friction losses in the pipe line, and of the entry head, or the friction losses at the suction entrance. These should be carefully determined for the maximum conditions under which the pump is expected to operate. The static head is the actual lift in feet measured from the water surface to the end of the discharge line, and is the sum of the suction lift and of the discharge lift. The friction head is the actual loss of head measured in feet necessary to overcome the frictional resistance in the pipe line. It varies as the square of the velocity and as the diameter of the pipe, and becomes very high for small pipes and high velocities. In figuring the friction losses for a mixture of water and solid material it is usual to add from 20 per cent to 30 per cent to the friction losses for clear water. The entry head, or the friction losses at the suction entrance, is the vacuum reduced to feet of head which is created in picking up the material from the bottom and in raising it to the water surface. This varies with the depth, the weight and condition of the material, and the per cent of solids pumped. For average conditions this can be taken at about 12 feet of head.

As the amount of power required, and to a considerable extent the amount of wear in the pump, are determined by the total head against which the pump will operate, it is advisable to make the total head as small as possible.

It is usual to figure on one pump as being suitable for a total head of about 125 feet. Where the required head exceeds this amount, additional pumps can be used as boosters, the pumps being connected in series; that is, the first pump discharges into the suction of the next pump, and so on.

Where the total head is expected to vary, provision must be made to vary the speed of the pump, the head developed varying as the square of the speed. Within small limits the head developed can also be varied by varying the diameter of the impeller, using smaller impellers for lower heads.

Considering next No. 4, that is, the speed of the pump, we find that the total head developed by the pump varies as the square of the peripheral speed of the impellers, and therefore, by varying the diameter of the impeller any speed required can be ob obtained. In the case of a directly connected pump the speed is frequently determined by the driver, and the diameter of the impeller is then made to suit that speed and the head requied. For belt driven pumps, the only limitations to the speed are the wear on the bearings and the wear on the interior of the pump.

The correct speed of a pump for a given head can be found approximately from the formula $R.P.M.=\frac{1680\sqrt{H}}{D}$, where H is the total head in feet and D the diameter of the impeller in inches.

The power required to drive a dredging pump is determined by the capacity of the pump in gallons per minute of water pumped, by the total head against which the pump operates, and also by the weight of material carried in suspension. When pumping clear water the power required may be expressed by the following formula:

$$HP = \frac{\text{Gals. per min.} \times H}{3960 \times \text{Eff.}}$$, the gallons per minute being the number of gallons discharged by the pump per minute, H being the total head in feet, and efficiency of the pump expressed in decimal fractions. The efficiency varies with the differing sizes of pumps, being about .25 for 2-inch pump, and about .65 for 20-inch pump. For pumping material, about 1 per cent additional power is required for every per cent of material carried in suspension.

Owing to the tendency of a dredging pump to overload the driver if the head is reduced, and because of rapid decrease in efficiency when wear takes place, a liberal surplus of power should be provided.

To illustrate the foregoing discussion, there are given in Fig. 1 the characteristic curves for a 12-inch heavy duty dredging pump illustrated in Fig. 3. This pump is ordinarily rated for a capacity of 4,200 gallons per minute. The efficiency of this pump at that capacity is about .65. At 3,000 gallons per minute the efficiency is about .60, and about the same at 5,600 gallons per minute. This pump can therefore be used efficiently for a velocity of from 9 to 16 feet per second in a 12-inch pipe. The head varies but slightly for the different capacities, but the horsepower increases very rapidly, being 133 HP. at 3,000 gallons per minute and 103 feet head, and 192 HP. at 5,250 gallons per minute and 95 feet head. It is evident from the above that if the length of pipe line or the static head becomes reduced while the speed of the pump remains constant, the capacity as well as the load on the driver will be increased considerably. Fig. 2 shows the relation between the speed of the pump, the horsepower required, and the total head developed in the pump when the capacity is kept constant. Fi. 2 shows clearly the rapid increase in head developed and in the power required when the speed of the pump is increased although the capacity remains constant.

In connection with the foregoing discussion it may be timely and of some service to give a few hints pertaining particularly to the installation of dredging pumps. These may be summarized as follows:

No. 1—Provide ready means for priming the pump and see that the pump is primed before starting.

No. 2—Make the suction absolutely air tight, otherwise trouble will be experienced in priming and in operating.

No. 3—Make the suction lift, that is, the height from the water surface to the center line of the pump, as small as possible, and make the suction line as short and direct as possible. The total vacuum is limited to 30 feet, or 34 feet of head, and the more used up in lifting water and overcoming friction, the less there is available for picking up the material itself. It is also more difficult to prime and to keep the joints tight when drawing high vacuum.

No. 4—Make the suction line flexible and provide the necessary rigging to handle it readily. The pump

will only pick up the material when it is loose and when the suction opening is right close to it.

No. 5—Exclude material from the suction that is too large to go through the pump.

No. 6—Avoid peaks and low spots in the pipe line. Peaks cause air pockets and the low spots will fill up with the material if the pump is stopped suddenly. The pipe line should, if possible, be laid with a gradual rise from the water surface to the pump and from the pump to the end of the discharge pipe.

No. 7—Provide easy access to the interior of the pump and into the pipe line. Use only long sweep elbows; they cause less friction and are less liable to choke up with material.

No. 8—Provide a supply of clear water to the water seal on the stuffing box. This will keep the grit out of the packing and will save the shaft.

No. 9—Provide suction and pressure gauges on the pump. They cost little and they tell what the pump is doing.

No. 10—Remember that pump parts and pipe line must be renewed at intervals. It is poor ecenomy to operate with the pump badly worn.

No. 11—Do not stop the pump when pumping material. Flush out the pipe line before stopping.

It may also serve some purpose to give here a list of the more common difficulties encountered in the operation of dredging pumps. These may be classified as follows:

N. 1—The pump refusing to prime, or not priming properly. When priming with an ejector, difficulty may be experienced, due to the following:

(a) The flap valve not being seated properly.

(b) Leak in suction pipe, pump casing or stuffing box.

(c) An obstruction in the injector.

No. 2—The pump not being primed properly. Unless the entire pump casing and the suction pipe are filled with water, trouble will be experienced in starting the pump.

No. 3—Air in the suction line. If the pump discharges a good volume at the start, which gradually diminishes or ceases entirely, the trouble is due to air leaks in the suction line. The vacuum and pressure readings will be low and irregular, or the gauges will not register at all.

No. 4—Obstruction in the suction line. This is indicated by a rattling noise in the pump casing and suction pipe and by a reduction in the volume of the discharge. The vacuum reading is high and the pressure reading is correspondingly low.

No. 5—Obstruction in the discharge line. This is indicated by reduction in the volume of discharge and by a high pressure reading and a correspondingly low vacuum reading.

No. 6—Material becoming lodged in the impeller. This is indicated by vibration of the pump and by general disturbance in the pressure and vacuum gauge readings.

No. 7—The head being too great for the speed of the pump. This is indicated by reduced volume of discharge and by the pipe line becoming chocked up frequently. This can be ascertained by reducing the vacuum and pressure readings to feet of head and comparing this with what the total head should be to secure good results.

No. 8—The head being too low for the speed of the pump. This is indicated by a large volume of discharge and by an overload on the driver. It man be determined by the same method as No. 7.

No. 9—The pump parts being badly worn. This is indicated by reduction in capacity and general inefficiency of the pump.

The foregoing discussion covers the general theory as well as the more common errors and troubles encountered in operation of dredging pumps. However, every dredging installation has its own particular problems which must be solved by the man on the job, and it is to him that this is respectfully submitted.

Dust Collecting System for Crushing Plants

"In a limestone crushing plant there is always a certain per cent of fine product that can be used for agricultural purposes. The fine product that is now escaping in the general operation of the plant can be saved by the application of a properly designed dust-collecting system," writes W. G. Clark, M. E. president, Clark Dust Collecting Co., Fisher Bldg., Chicago. This, of course, will prove a source of revenue, as the demand for this kind of material is now very brisk, and every ton that is saved can be sold at a good figure, and at the same time, the sanitary condition of the plant is vastly improved and there is a saving in wear and tear on machinery.

"Under present conditions I believe it is profitable to take the finest material from the screen, pulverize this to the proper fineness and sell this material for agricultural purposes. I have concluded that a mixture of material all the way from 8-mesh up to 200-mesh is ideal for the average soil. Therefore, in order to produce the most marketable and desirable product, it would be necessary to mix the extremely fine dust with a certain percentage of coarser dust, ranging in size from 8 to 60-mesh. The mixture should be about one third of the coarser particles; that is, from 8 to 60-mesh and two-thirds of 60 to 200-mesh.

"By using the fine material coming from the average screen, say the first 3 or 4 feet of the screen, and running this to a pulverizer and pulverizing it down to the grade mentioned above, there could be produced a product that would be very marketable, and which I think would prove very beneficial to the agricultural production of the country. It must also be borne in mind that rock that is pulverized for this purpose must be reasonably dry.

"I am satisfied that if the crushed stone industry will use its efforts to produce this class of material the farmers will be vastly benefited, and it will produce a revenue for the stone-crushing plant and prove a financial advantage.

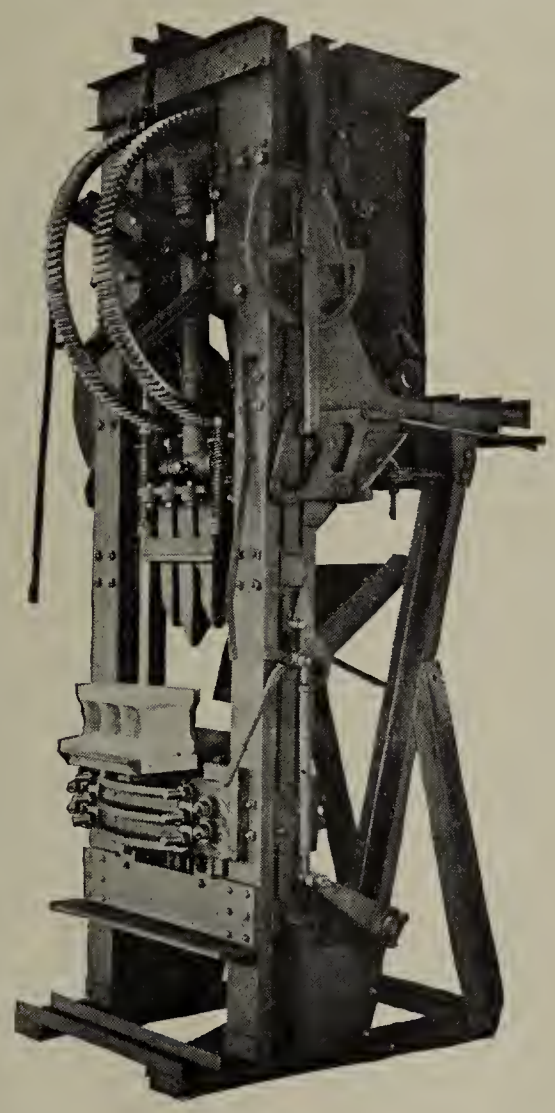
"It seems strange in these times of conservation and economy that the stone-crushing plants will allow this valuable dust and fine product to waste away. They spend thousands of dollars to reduce their stone to different grades, and in this process there is more or less per cent of extremely fine material unavoidably produced. There is carelessness and indifference about saving this dust. I think the time is opportune for the stone-crushing plants of America to give this phase of their production their very best and prompt attention. Now is the time to act, as our agricultural industry demands a good and cheap fertilizing agent.

"In doing this, crushing-plant operators should realize the following advantages: A big revenue in material; a better sanitary condition in the plant; a great saving on wear and tear on men and machinery; economy in operation; serving one of the country's most urgent needs.

Automatic Block Machine

The Post Economy Punch automatic block machine sold by the Kent Machine Co., Kent, Ohio, is an absolutely new and original method of manufacturing concrete blocks. A guaranteed output of over 2,000 blocks per day with four men is assured. The Post Economy Punch compacts the concrete in the mold by punching out the cores and forcing the concrete to the sides. Tamping is eliminated.

This machine is the invention of A. L. Post, the inventor of the Kent concrete mixer, which is well known to concrete products manufacturers. The Post Economy Punch has been thoroughly tested and has convinced men thoroughly versed in concrete block manufacturing that it produces blocks that are very dense in structure, free from voids, absolutely square



and smooth, and which stand the various building code tests, both as to structure and absorption.

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block by the machine. Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator. Troweling is unnecessary. The machine is sturdily built for rapid, continuous operation. It is simple in design, self-contained, operates without noise, and will give long service as it requires only one punch to produce each block.

It functions automatically, through simple power driven devices, a 5 h. p. constant speed motor being required to drive entire machine, or it may be driven from a line shaft where steam power is used.

Material is measured through an adjustable measuring device at bottom of hopper, this being operated by means of a cam which during up stroke of machine draws a series of prongs through material, cutting off material above until charge has been released and the bottom door has been automatically locked. During down stroke of machine these prongs are drawn back, allowing material to fill the measuring device again.

By merely pulling a lever the measured charge is allowed to enter mold box, then the clutch is thrown in by means of another lever. The ram makes one complete revolution, the power stroke driving the plungers through the mass of concrete, followed up by the stripper plate, thus creating a pressure in all directions. Return stroke strips the finished block from both the plungers and mold box into position to be carried away.

Post blocks made on Post Economy Punch are original in design, light in construction, strong. These blocks allow circulation in the wall in both vertical and horizontal directions, regardless of how laid.

Business Analysis of United States Made By Counties

With students of business conditions universally agreeing that the business tide has turned, and that success in the future will come to those who plan carefully now, the subject of the following review by Mr. Williford I. King of National Bureau of Economic Research, Inc., 474 W. 24th Street, New York City, is particularly interesting and timely.

"The Wm. H. Rankin Company has recently compiled a handy book giving important statistical facts of interest to business men. The report shows for each county in the United States the respective values of farms, or crops and of manufactures, the white population of the county, the number of automobiles registered, and the mileage of all roads. The figures for surfaced roads are also recorded separately. All of the preceding figures are taken from the latest available official statistics. An estimate has also been made of the total income tax paid by the people of each county. The summary for each state includes in addition to the items given for counties a record of the chief facts concerning the climate.

"Each volume consists of a flexible leather binder containing loose leaves which can be replaced as later information becomes available. Expense has not been spared in making the books attractive and convenient.

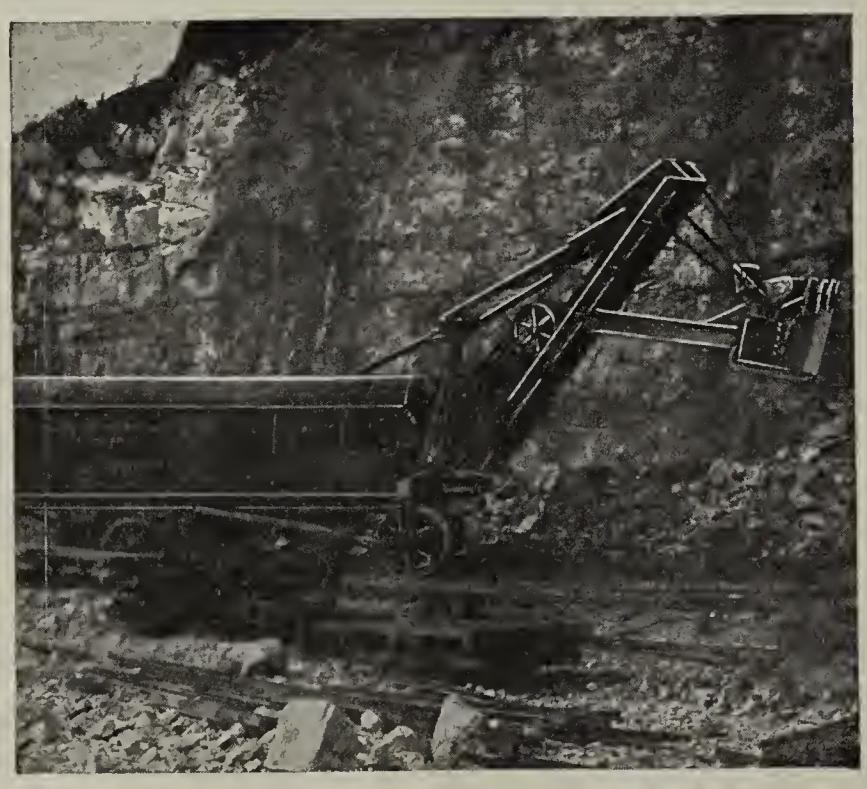
"It is easy to see that this work will prove a great convenience to business men who are interested in selling campaigns. It gives them in two volumes the information which would otherwise have to be dug out of a whole shelf full of government reports and the compact form of presentation greatly facilitates reference and comparison."

Steam Curing Products

Steam curing of concrete blocks and tile is treated fully in the book "Concrete Stone Manufacture" by Harvey Whipple, 320 pages, 185 illustrations, cloth bound. Price $1.50. If you like it, keep it—if you don't, the publishers, Concrete Cement Age Publishing Co., New Telegraph Bldg., Detroit, Mich., will buy it back.

Electric Shovels

The past three years have seen a further development of the largest installation of Electric Shovels in the world. This is at the mines of the Chile Exploration Company, Chile, South America. The copper ore available is located on a mountain range and has a very low copper content requiring that enormous quantities of the ore be mined at a low unit cost. Steam shovels, which usually cost considerably more to operate than electric shovels, were formerly used for this work. In this particular case the cost of operation of the steam shovels was even higher than usual, due to the fact that coal and water had to be hauled long distances from the Company's property at the sea coast to the mountain. Five large electric Bucyrus shovels driven by Westinghouse A.C. motors were installed in the latter part of 1917, the power being transmitted at high voltage to these shovels and the voltage reduced to 500 volts by step-down transformers located on the rear of the shovels. The operation of these shovels was so successful and the reduction in cost so great that five more of these large electric shovels driven by Westinghouse A.C. motors were placed in operation at these mines during the



No. 70-C Bucyrus Electric Traction Shovel

past year. The hoist motion on the shovel is driven by a 259 h.p. motor and the swing and thrust motions each by a 75 h.p. motor.

Electric shovels are used by the Hydro-Electric Power Commission of Canada in digging the Queenstown Chippewa Power Canal around Niagara Falls. There is a difference in elevation between Lake Erie and Lake Ontario of 330 feet. This power development will operate under a 305 ft. head. The flow of water in the canal, when the plant is operating at full capacity, will be 10,000 ft. per second and the plant will develop 300,000 horsepower.

The length of the canal will be 13½ miles. The Welland river is used for 4½ miles for this canal, the remaining 9 miles being excavated. The Bucyrus electric shovels used in digging this canal have made some remarkable output records in the last year. In one ten-hour shift as high as 4930 cubic yards of earth were removed by one 300-ton shovel. This is the equivalent of a day's work of six hundred men. The shovel making this record, which is of the revolving type, is the largest shovel ever built having a boom 90 feet long. There are three shovels of this size and four smaller ones used on this work. All of these shovels are driven by Westinghouse A.C. motors.

The electric shovel is making rapid strides in replacing the steam shovel in all kinds of excavating work.

F. L. Smidth & Company's Washmill

The washmill, designed by F. L. Smidth & Co. of New York, for the manipulation of soft earthy materials with water, produces a homogeneous pulp or semi-liquid mass technically known as slurry. It is mainly used in the Portland cement, brick, kaolin, phosphate and iron industries. In some cases the washmill, is merely used for the production of a homogeneous pulp from materials in their natural condition. In other cases it is used to free plastic substances from solid substances; as, for example, clay from phosphate rock; kaolin and brick clay from sand and foreign impurities from iron ore. More or less solid lumps of materials are subjected to a certain amount of attrition, thereby effecting disintegration and an easier formation of pulp or slurry.

In Portland cement plants operating by the wet process, the washmill is used to prepare the materials either for the preliminary grinders or the finishing grinders as may be required.

It consists of a circular or polygonal concrete basin which is usually lined with paving blocks. It is provided with a heavy center pier supporting a vertical shaft upon which revolves a spider actuated by bevel gear and pinion. The spider carries heavy harrows or drags which travel close to the bottom of the basin, and which by their motion drag the material over the bottom of the washmill thus agitating and disintegrating the material until it forms a pulp or slurry with the water. The material is fed through a large chute on one side of the basin; the discharge ordinarily arranged on the opposite side, consists of a grate with suitable openings through which the finished material may pass into a pump pit, a separator or a storage basin as the case may be.

The washmill is manufactured in two sizes; the larger size is 26 ft. in diameter and, on plastic materials, has a capacity of up to 35 tons an hour dry weight. It requires from 25 to 40 h. p., depending upon the nature of the material. The smaller size is 20 ft. in diameter and, on plastic materials, has a capacity of up to 20 tons per hour dry weight, and requires 15 to 25 h. p., depending upon the nature of the material.

The manufacturers claim that the cost of upkeep of the washmill is extremely small in proportion to the tonnage handled. Th eprincipal wear is upon easily replaceable harrow teeth. It is a slow speed device making from 8 to 10 revolutions per minutee.

The washmill is recommended to Portland cement manufacturers operating by the wet process and using soft limestone and clay marl and clay, chalk and clay, or soft shale and plastic clay in connection with hard rock, as a most economical and convenient device for the purpose stated.

Literature and further information may be had from F. L. Smidth & Co., 50 Church St., New York City.

Nothing to Sell But An Idea*

Some high lights which reflect the real purpose of the Portland Cement Association. In expanding the market for raw materials the dominating method is to know as much as possible about the adaptability of those materials, declares Mr. Campbell

By H. Colin Campbell

Manager of the Portland Cement Association's
Advertising and Publications Bureaus

Probably no one will ever complete a list of all ways and means to expand markets for raw materials. Certainly a dominating method is to know as much as seems possible about the adaptability of such materials. This known, it is evident that one can then direct his attention toward seeing that they are used so that the best results possible will be realized. The ways of using any given raw material may be numerous.

The man who needs mortar to lay cut stone, brick, or concrete block sees nothing that will satisfy his need in the mountain of rock which after being put through a multiplicity of processes becomes portland cement. Yet the mountain of rock has a distinct value because a market has been made for it through the discovery that when put through certain processes it will become one of the strongest binding or bonding materials known.

Portland cement, even after having reached the dignity of a manufactured product, is still a raw material until those who are to use it know and apply the ways and means necessary to most efficient and effective use.

The unqualified statement may be made that no manufacturer, no producer of any raw material, as first defined, can separate or isolate himself from the many enterprises going on about him if he expects success. A careful study will disclose a lead which shows his relation to and interdependence with many other enterprises, sseemingly remote from his commonplace individual interests and of vital concern to the ultimate success of his business.

Cement Once a Mountain of Raw Materials

The discovery that a mountain of raw materials could be converted into portland cement is in itself an illustration of the expansion of markets. There are not far from 100 distinct operations that must be performed before a sack of cement can be turned over to a prospective purchaser as a product ready for use. Each one of these operations requires some related operation, the use of some device, the carrying out of some method that calls for machinery fuel to drive it, laboratory work of a high order to determine quality. In other words, the seemingly simple process of tearing down a mountain and putting it through a sieve, makes and expands markets for a variety of other raw materials in direct ratio to the demand developed for the finished product.

If cement mills were to be shut down because there were no longer any demand for their output, there would immediately follow a reduced market for iron and steel, a great variety of tools, machines, dynamite, etc., necessary to equip and operate such plants. As a result there would naturally follow the loss of a field for the sales efforts formerly directed toward securing purchasers for the product normal to the abandoned industry. In other words, the far reaching effect of continuance or suspension of cement manufacture would soon become evident.

The Association a Voluntary Organization.

The Portland Cement Association is purely a voluntary organization. In popular conception it is classed as a "trade association." While there are other associations operating as we do, I think it safe to say that our method of operation is unique in that it has greater ramifications than any organization with which we may be compared.

Practically all of the cement manufacturers in the United States and Canada belong to the association. We have members even in Cuba, Mexico, and South America. That we have these foreign members may seem strange to you when I tell you that the association is not in any way concerned in the commercial aspects of the cement industry. The reason for this membership is due to the far-reaching effect of our educational work and the inestimable value which cement manufacturers place upon it as an aid to stabilizing and expanding the market for their product.

We have 24 offices in different parts of the country. The underlying idea of the association is expressed in that often used, much abused and sometime meaningless word "service." Our headquarters in Chicago is the executive center for all of the activities in which we engage. Each district office, is a service organization on a smaller scale, although sufficiently complete to efficiently service its territory. Depending upon the number and intensity of various campaigns we may be engaged in, our staff averages around 300. Most of our men are technically trained—usually civil engineers. Also most of them are, or soon become, "peculiar" engineers in that they are able to keep their technical or professional training from interfering with the ability to put their ideas and aid in such form as to make popular consumption easy. They are trained in promotion. They are salesmen who have nothing to sell but an idea, which is "Concrete for Permanence."

Our headquarters, as well as the district offices, is departmentized. Specialists are delegated to the classes of educational promotion to which they are best fitted. Agriculture, building construction in its broadest sense, sanitation, highway engineering, from the simplest to the most stupendous structures required in any given field, are all reduced to terms of concrete.

The Backbone of the Scheme

Probably the backbone of our whole educational scheme is in our Structural Materials Research Laboratory, operated jointly and in co-operation with the Lewis Institute, Chicago. Here a large corps of trained men are engaged in research work on the uses of cement and concrete. Since 1916 considerably more than 100,000 chemical and physical tests have been made in this laboratory solely to determine how best

---

*Abstracted from Mr. Campbell's address before the First National Industrial Advertising Conference at Milwaukee on June 13.

to use concrete as well as how not to use it—in discovering and establishing the possibilities of cement as expressed in concrete construction.

Notwithstanding the association is 20 years old—and during all that time has been attempting to further knowledge on the use of concrete—within the last seven or eight years we have learned more about how, and how not, to use it than was known in all the years before.

The evident advantages of concrete construction were early recognized and tempted many to write their own specifications for using the material, with the natural result that cement—the principal ingredient—was discredited because of faulty use. Practical guidance, based on scientific knowledge and established facts, was necessary to prevent abuse of a worthy material.

Until within comparatively recent times, nothing was known as to the effect which clay and other impurities as an admixture with the sand and pebbles used in concrete might have on the strength of a finished structure. Studies have been made in our laboratory on the effect, size and grading of aggregates have on concrete; of using different types of aggregates; of impurities in aggregates; of powdered admixtures in portland cement such as coloring matter and hydrated lime used for a definite purpose; the effect of impure mixing water such as impurities caused by industrial waste, etc.

At first glance, these studies might have but remote connection to expansion of the market for cement. However, as an example, our studies on the effect of size and grading of aggregates as related to a concrete mixture have been most forcibly illustrated on a piece of concrete highway construction now in process in the Imperial Valley, California. At the quarry where the aggregates were being obtained methods employed in screening the crushed stone for the concrete mixture caused a waste of 35 per cent of the materials taken from the quarry.

One of our field engineers, who was rendering the usual co-operative service to those in charge, suggested that a change in the methods of screening, based on our laboratory tests, would considerably reduce this waste. His suggestion was adopted with the result that a waste of only 15 per cent followed the changed methods. What this meant to the taxpayers was that instead of costing $1 a ton to prepare, the stone costs 42 cents—$30,000 were saved, which made it possible for the community to build an extra mile of concrete road and at the same time made a market for 3500 bbl. more of cement.

More Educational Work.

Among the classes of educational work carried on are lectures before agricultural colleges, farmers' institutes, engineering colleges and universities, co-operation with county agents, architects, engineers, contractors, building commissioners, having to do with revision or writing of building codes, vocational schools in which we endeavor to establish simple courses in manual training through the use of concrete, etc.

You will also find our field engineers on many a piece of concrete construction serving in an advisory, consulting or inspecting capacity in co-operation with the engineer, contractor or architect under whose immediate supervision the project is going on. We also have a motor truck with complete concreting equipment giving demonstrations in the actual "how" traveling throughout the country.

We have assisted many aspiring men to go in the contracting field specializing in concrete construction. We have promoted through educational work a higher standard for building codes in many cities and are continuing this work everywhere that our aid is asked. The result is certain to be expressed ultimately in economies of construction, more highly fire resistive construction, consequent reduction of natural fire losses—a distinct service to the public, an establishment of a certain amount of resultant good will and an extension of the market for cement.

We distributed several million booklets last year discussing the advantages of the use of cement in construction in many fields. "Concrete on the Dairy Farm," "Concrete on the Hog Farm," "Concrete Around the Home" are typical titles. We have booklets devoted strictly to concrete construction in specialized structural fields. These booklets are continually revised by incorporating the latest information disclosed by study, research or experience and are in that way kept up to date.

We use miles of motion-picture films. We have a film showing the numerous processes involved in the manufacture of portland cement. Hence it does not require a high order of intelligence to realize a sack of cement represents the combined expense or cost of many operations, one of which, for example, is the use of 50 lb. of coal.

The advantages of paved barnyards are displayed through the medium of animated cartoon films circulated in rural communities. We have many reports showing that after a local cement dealer had displayed one of our animated cartoon films in his community he sold within a week or 10 days cement for several concrete feeding floors. We have no connection with cement dealers other than placing at their disposal motion-picture films or other educational matter which they may wish to use in the immediate furtherance of cement sales. Occupying this unique position with relation to the industry we can devote our whole time and talent to further expansion of our educational methods and to the developments of new ones.

Few people seem to take into account at times one vital fundamental that would put their 90 per cent success in the 100 per cent rank. Do those who produce sand and gravel and crushed rock—those materials which we refer to as "aggregates"—always remember what a business the discovery of cement made out of these materials and how rapidly the increasing use of cement in the form of concrete construction is expanding the market for these materials?

Protecting the Market's Purchasing Power

Concealed within our slogan, "Concrete for Permanence," is the idea of protecting the purchasing power of the market. The cement manufacturers' market is the whole United States, because every human being, whether he knows it or not, is dependent in some way upon cement as expressed in concrete construction. It is practically a universal building material; it has been established as the highest type of fire resistive construction. It has been shown to possess strength and endurance unexcelled, because, as we are wont to say, "the maintenance is built into it." It is building maintenance into any product that makes that product capable of rendering the highest degree of service. Although this may make the product cost more in the beginning, it will prove far less expensive to the purchaser or user in the end. It is such products that build that capital stock of inestimable

worth known as "good will" because they conserve the purchasing power of their market.

Co-operative Advertising

In my estimation, there is too little co-operative advertising. Even among the large number of trade associations, of which there are several hundred active ones, there are only a few which advertise regularly. True, from the standpoint of joint advertising, there are problems sometimes difficult of solution to the satisfaction of the many members constituting an association. But if the individual members of such organizations could only be convinced of the desirability of subordinating trademarks, of suppressing petty differences and of uniting in a fundamentally sound campaign to reach one objective, namely, favorable public opinion, they would find a great deal of the resistance encountered in common sales methods overcome.

Advertising as an institution is old, but old as it is, it is nevertheless young. Often little can be predicated as to the results which any kind of advertising may be expected to produce. The objective sought by all advertising is the cultivation of favorable public opinion, which is another way of saying building good will, and hence sustaining and expanding a market. Any publication which has a circulation of character, no matter how small that circulation may be, has a definite value as an advertising medium. The kind of appeal as represented by copy should be worked out very carefully after it is certain the objective to be reached has been thoroughly understood. A good many people are sincere in thinking that they want a certain thing or desire to attain a certain end, when in reality they do not because they have failed to give their motives and desires proper study and proper co-relation.

Trade papers are immensely valuable to the advertiser who wishes to reach the field they cover with least possible cost and waste. General magazines are of immense value if used persistently over a long campaign with editorial copy that can reason and explain, and thereby round out a course of education. Neither of these classes of publications, however, so long as established methods of making them prevail, can occupy the definite field and value of the newspaper.

Magazines worthy of use are generally of national or large territorial circulation. It is impossible to concentrate appeals in narrowly prescribed territories through their use.

Through newspapers concentration can be secured wherever desired and by a well-chosen schedule of newspapers zones of circulation can be made to overlap and effective national circulation secured if desired, while the institutional appeal can at the same time be combined with local intensification.

Scrapers and Excavators

Sauerman Bros., 1139 Monadnock Bldg., Chicago, have recently issued two new bulletins—No. 16 describing Sauerman power scrapers, and No. 17 describing Sauerman dragline cableway excavators. An interesting feature of the latter is an areoplane view of sand and gravel plant showing a Sauerman cableway excavator in operation. Both bulletins are also fully illustrated with actual operations together with valuable descriptive matter. Either one or both of these bulletins will be sent on request.

New Orders for Bradley Mills

The Bradley Pulverizer Company announce that they have received a contract for four of the new Gear Driven BRADLEY HERCULES MILLS for the new plant of the Phoenix Portland Cement Company which is to be built at Birmingham, Alabama. They are also supplying the Dexter Portland Cement Company, Nazareth, Pa., four machines for their new plant at Nazareth. Both of these companies will use the gear driven BRADLEY HERCULES MILLS for the reduction of raw material and cement clinker.

This is another indication of the popularity of the BRADLEY HERCULES MILL as a semi-fine preliminary grinder.

In making this selection, the two companies above carefully investigated all types of pulverizers and decided on the BRADLEY HERCULES MILLS on account of their low power consumption, low maintenance cost, and large output; dustless operation was a big feature with the Phoenix Portland Cement Company.

Other recent installations of the gear driven BRADLEY HERCULES MILL were at the Marquette Cement Manufacturing Company for reducing clinker; the Universal Portland Cement Company at Universal, Pa., for reducing raw material; the Giant Portland Cement Company at Egypt, Pa., for the reduction of raw material.

The BRADLEY HERCULES MILL has shown an average output of 40 tons per hour in all parts of the United States, and from 100-175 barrels per hour when reducing clinkeer, 50-60% through 100 mesh sieve.

This extreme fineness makes an ideal tube mill feed, one which increases the output of any tube mill and consequently reduces the horse power requirements for the grinding unit to the minimum.

Power Hoe

In its book 444 the Link-Belt Co., Chicago, describes its improved drag scraper the power hoe. Twenty years ago this company was installing the drag scraper, and while the hoe is not a substitute for all other types of elevating, conveying, unloading, reloading, scraping, storing and reclaiming equipment, the company points out that it is in a position to give its correct application, keeping in mind that each type has certain conditions to which it is best adapted. This 24-page booklet contains descriptions and illustrations showing the many applications of the power hoe.

Well, Cistern and Silo Molds

Wert Mfg. Co., Railway Exchange building, Chicago, is distributing a circular describing the Perfect well, cistern and silo molds it manufactures. These molds are built of 12 gage sheet steel reinforced with 1½-in. T iron. They are all 8 ins. high. Sizes vary in length so that a certain number of blocks will make the circumference without using any pieces or fractional block. They are manufactured in two sizes for walls either 3 or 4 ins. thick. Very simple and easy to operate.

Design and Construction Details of Recent Montgomery Ward & Company Buildings

Two buildings completed a few years ago by Wells Brothers Construction Co., Chicago, for Montgomery Ward & Co., a large mail order house with headquarters in Chicago, have attracted more than ordinary attention, not only because of interest in the details of their construction, but because of the size of the structures. One of these buildings is located at Portland, Ore., and the other at St. Paul, Minn.

The rather unusual design of the Portland plant was developed through economic consideration. Railroad approach is from the front and tracks are carried directly through the center of the building to unloading platforms between the rear wings. Entry for visitors is provided at the second story level, immediately above the railroad tracks and approach is given by an incline from right and left. Employe's entrances are placed at the side at the second floor level.

Direct entry for receiving and shipping is on each side of the railroad tracks and runs under the inposed of precast units. Extreme care was used in filling forms and in their removal, in order that a minimum of patching might be necessary, while barricades were erected to prevent injury to the finished concrete at doorways.

All exposed surfaces on the St. Paul building, with the exception of cast iron spandrels, are of concrete. In the tdministration section concrete was placed continuously so far as possible in the exterior walls to avoid horizontal construction joints. When completed the surfaces were rubbed with carborundum blocks and white cement grout, thus producing a uniform and attractive white surface texture.

As is often necessary and particularly advantageous when the builder is retained under a service contract with a flat fee as remuneration, work was started prior to the complete development of plans. Only the general contour of one of the rear sections was determined when active construction was started.

The Mongomery Ward & Co. Plant at St. Paul is of Monolithic Concrete. The Exposed Concrete Surface Was Given Special Treatment With Striking Effect

clined approach to the main entrance. The slope of the ground was such as to make this separation logical, and the resulting effect has been to lend considerable interest to the building through the unusual design of the inclined approach.

Flat slab construction was used, spandrels being of red-faced Shape process portland cement brick, with curtain walls of plain portland cement brick. This product was slightly higher in price per thousand than either common or faced clay brick but the greater size of the cement brick compensated for the increase in price. Tests of absorption of the brick were also made and the results were favorable to the cement product. The Shope Brick Co., of Portland supplied the cement brick, 1,000,000 of the plain and 200,000 of the faced type being required.

The construction plant consisted of one central tower and a one-yard "Boss" mixer, manufactured by American Machine Co., Keokuk, Iowa. A maximum day's run of concrete was 525 yards in 9 hours, while 500 yards was frequently exceeded. Work started December 26, 1919, and the building was turned over to the owners in October, 1920.

St. Paul Plant More Ornate

The administration section of the Montgomery Ward building in St. Paul is an adaptation of the Ionic order without intricate detail, but with sharp corners and some cylindrical columns. The latter are com-

The tower seen in one of the illustrations is the feature of the plant and rises from the front of the rear section. It is built integral with one of the wings, the upper portion acting as a cantilever from the structure, giving greater stability than had it been cantilevered from the base. Its area at the level of the warehouse roof is 4 panels and is reduced to one-half at the three-quarter point. The concentration of load from the part above at the points between columns necessitated special construction. It was possible to make use of concrete girders but their depth would have been undesirably excessive, so 9-foot deep steel girders were used.

Four concreting plants were installed at St. Paul, two major plants serving the warehouse sections. The latter were set below ground level with overhead bins at such a height that motor trucks could dump directly into the bins from an inclined drive. Cement stored in small buildings close to the plant was trucked to the working platform. All concrete was handled by buggies from the towers. The major plants were each able to maintain a capacity of over 500 yards per day, although the maximum seldom occurred at both sides on the same day, carpenter and concreting gangs being shifted from one side to the other, in order to avoid confusion.

Mixing plants for the administration section, which involved small yardage, were smaller and aggregates piled adjacent to the mixers were wheeled to them.

Also self-dumping material hoists were installed at points convenient to the carpenter shop and steel stored as close as possible to the base of the towers.

Details of Design and Construction

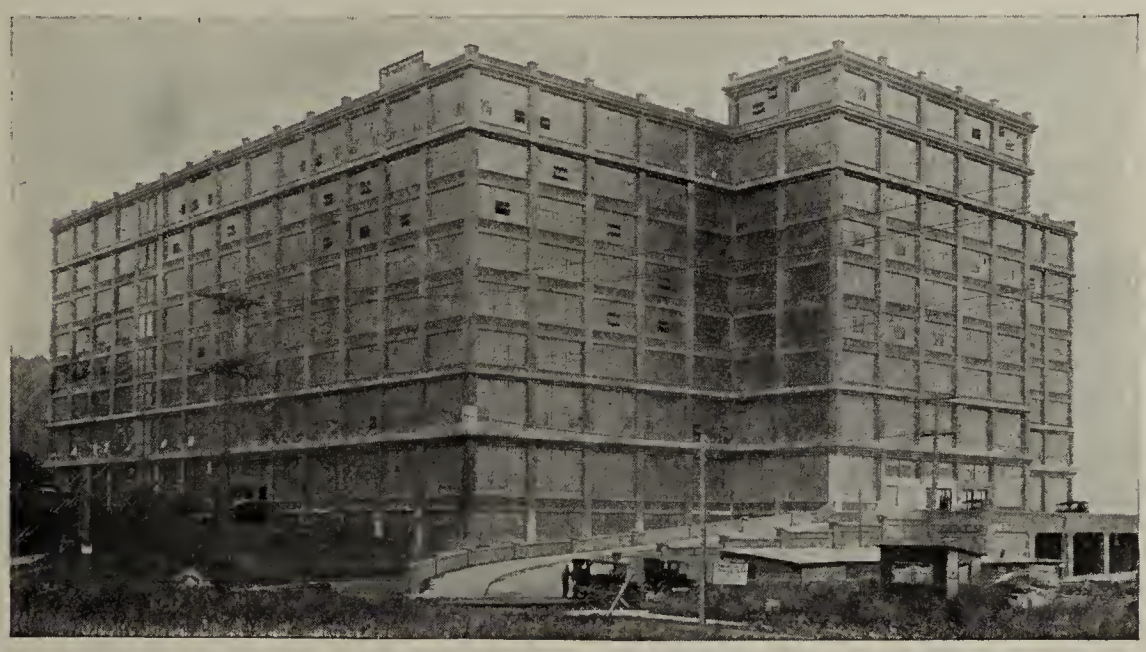
Several interesting details were incorporated in the design of the two buildings. In order to permit a later addition to the rear of the Portland building, brackets were built at each column head in the rear line of columns, on which beams of the future building may rest. These brackets are partly exposed. Provision for the future extension of the St. Paul building is made by means of a row of footings on the line between the present and future buildings, suitable for additional columns. The columns were made rectangular so that when the addition is made the appearance within will not differ from that elsewhere in the building. The plan used at Portland was the less expensive, but also the less attractive. But appearance at the rear of the Portland building was of little consequence. In the St. Paul building, double half-round columns were used wherever expansion had to be provided, as between the tower and one wing and also in the center of the administration building.

As everyone engaged in construction knows, 1920 was marked by serious transportation difficulties. This seriously interfered with continuous delivery of materials in required quantities. For operations at St. Paul a concession was obtained from the Chicago, Milwaukee & St. Paul Railroad permitting the use of 75 stock cars between a cement purchasing point and St. Paul, providing they were loaded within 24 hours, delivered at one siding on the owning railroad's line and unloaded within 24 hours. These were almost impossible conditions to meet, particularly at the receiving end, but by being prepared with a large number of trucks and by erecting temporary storage sheds sufficient to take care of a trainload of cement, the shipments were handled without undue difficulty, helped to some extent by the fact that the railroad was unable to deliver cars in one train.

Several carloads of steel were shipped from Youngstown, Ohio, to Portland, Ore., with a man following each car. Through such efforts it was possible to get shipments through, often within 11 days.

The administration section of the St. Paul building is 586 feet long and three stories high. The two rear wings are each nine stories high, one being 220 feet long and 120 feet wide and the other 220 feet long and 140 feet wide.

For the above information we are indebted to F. A. Wells, Vice-President of Wells Brothers Construction Co., under whose general supervision th eSt. Paul job was carried on, to P. A. Wells of the same company, who superintended the Portland job, and to C. H. McCaully, construction engineer for Montgomery Ward & Co., in charge of design and construction. W. A. Forshee was resident superintendent at St. Paul. Lockwood, Greene & Co. were associate architects.



Flat Slab Concrete Construction With Spandrels of Shope Process Cement Brick Was Used for the Portland Plant of Montgomery Ward & Co.

Mixer for Concrete Products

Anchor Concrete Machinery Co., Adrian, Mich., is distributing a folder descriptive of the Anchor batch mixer it manufactures. This is especially designed for use in concrete products plants. In designing this mixer it has been the aim of the company to produce a machine that will thoroughly mix concrete and one that is rapid in operation, simple in construction, easy to operate and sturdy in construction. Base legs are 26½ in. high, heavily constructed of high grade gray iron. The bottom is also the best quality gray iron ⅝ in. thick, firmly bolted onto the legs. There is a circular opening in the bottom through which the batch or any part of it is discharged into wheel barrow, chute or elevator hood. The circular shaped door is heavily constructed and does not clog or bind. Drums are 14 gauge sheet steel firmly riveted onto the cast bottom and are reinforced at the top with a steel channel hoop. Mixing arms are made from crucible steel, cold rolled screw stock. Shovels or blades are of the best quality steel and are adjustable. The blades are operated by heavy cast gear and pinion. The drive shaft is 1¾ in. Power on the 7-foot mixer is transmitted through a tight and loose pulley, which furnishes a simple and efficient method of driving.

News of the Cement Mills

The third edition of the new book on the manufacture of portland cement by Arthur C. Davis is just off the press. Revised and enlarged, 8½x6 inches, 416 pages, flexible leather cover and enlarged, 100 illustrations. It is published by John Falconer, 53 Upper Sackville street, Dublin, Ireland, who has the following to say concerning this work, viz: "The Authors' Lectures at the University of Cambridge upon the modern manufacture, testing and use of cement, and those more recently delivered for the Royal Society and the Institution of Civil Engineers (and for which Mr. Davis was awarded the Mullins Silver Medal), have awakened a new interest in the science and technology of Portland Cement. I have thus decided to publish a third edition of the Author's book on the subject for the information of cement users.

"The entire contents of the second edition have been rewritten and brought up-to-date by the insertion of matter dealing with the latest available information concerning the manufacture and testing of Portland Cement, including a description of the newest labor saving devices and testing appliances and methods, and the latest theoretical conclusions as to its constitution.

"The Author has taken pains to make the science of cement an easy subject for study by the consumer, and the valuable illustrations included in this new issue add additional interest and will further explain the text to those readers whose business it is to treat with Portland Cement."

The contents of this new book are as follows, viz: Composition of Portland Cement, Mineralogy of Cement, Raw Materials, Raw Materials—Mixing, Estimation and Analysis of Raw Materials, Burning of Calcining, the Rotary Kiln, The Rotary Kiln—Fuel Valuation, Efficient use of Fuel in Rotary Kilns, The Rotary Kiln—Flue Gas Analysis, The Rotary Kiln—Historical, Clinker Grinding, Motive Power and Factory Efficiency, Chemical Analysis, Mechanism of Setting and Hardening, Sampling, Testing and Uses, Fineness and Sieving, Tests for Bushel Weight and Specific Gravity, Setting Tests, Soundless, Contraction and Expansion, Tensile Strength Test, Compression and Transverse Tests. Send on receipt of price ($6.25) by John Falconer Publishing Co., 53 Upper Sackville street, Dublin.

Wm. A. Ernst, formerly chief chemist for the National Cement Co., Ragland, Ala., has resigned to accept a position with the Gulf States Portland Cement Co., Demopolis, Ala. Mr. Ernst was for many years connected with the plant at Ragland from the time it was known at the Atlantic & Gulf Cement Co., then as the Coosa Portland Cement Co. and afterwards as the National Cement Co. In his new position he will have full charge of the chemical department of the Gulf States Portland Cement Co.

The Globe Portland Cement Co., 416 McKnight building, Minneapolis, Minn., will erect a cement plant at Dubuque, Ia., with an expenditure of about $2,000,000. The architect and builder is the H. C. Struchen Co., St. Paul.

The Egyptian Portland Cement Co., Port Huron, Mich., has closed a lease for the former Grand Trunk steel car shops plant and will begin the production of cement in February. The plant has river frontage and the work of bringing stone to the plant by water will begin at once.

The Monolith Portland Cement Co., with main offices at Los Angeles, Calif., is securing additional capital to increase the capacity of its plant by distributing a portion of its stock among the users of cement as well as with the public. During the past year the company reports sales of more than 1,000,000 sacks of cement in its immediate territory. A new kiln for burning lime rock has been ordered. The plant is running 24 hours, with three complete shifts.

The following is a copy of a letter recently sent to its retail dealers in distributing territory of Indiana, Illinois, Iowa, Michigan, Ohio and Wisconsin by The Sandusky Cement Company, viz.:—

"Just because we raised our price on Medusa Cement on July 30th last, we are not profiteers.

"In justification of our act, let us quote you direct from our official cost records:

Cost per ton 1st 4 mo. '22	Cost per ton May & June	Cost per ton July 1 to 15	Cost per ton July 16 to 31
COAL*			
$4.02	$4.85	$9.64	$10.64

(*All prices f. o. b. our Bay Bridge, Ohio, and Dixon, Ill. Plants.)

"It takes 200 lbs. of coal to burn one barrel of cement. Therefore, every $1.00 per ton on cost of coal equals 10c per barrel on cost of finished cement.

"It is readily seen that the one item of coal entering into the cost of manufacturing a barrel of cement shows an increase of 66c per barrel during the last fifteen days of July over the first four months of the current year, and no immediate prospects of relief.

"LABOR—The first four months of this year we secured all needed common labor at 25c to 28c per hour. Today we are paying for same class of labor 35c per hour or an increase of 25%. All semi-skilled and skilled labor in like proportion.

"SACKS—During the winter of 1921-22 cement sacks could be purchased at 9½ and 10c each; today the cost is 16c, an increase of 6c per sack or $6,000.00 per car. We still charge you but 10c for each sack. We purchased our last car of 100,000 sacks on June 28th, 1922. We have purchased 500,000 sacks since January 1st. This last purchase was made due to Medusa Sacks not being returned as promptly as might be, nor in proportion to increased shipments due to heavy storage on part of contractors.

"These are but three items that enter into the cost of producing a barrel of finished cement. The above figures are accurate as applying to Medusa Cement.

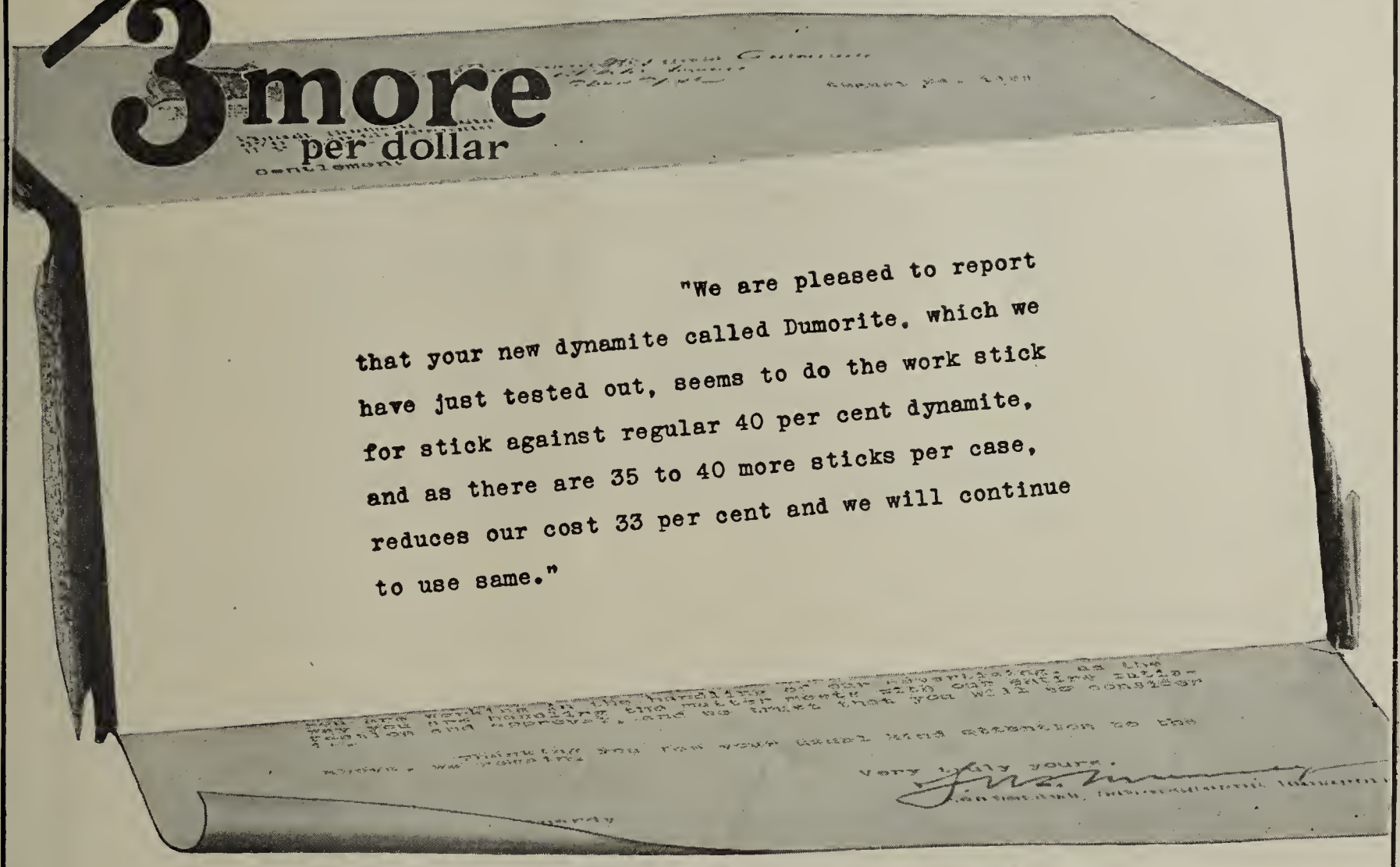
"Permit us to ask: would you raise your price if you were in our position?

"Now gentlemen, these statements are made and figures quoted in a sincere endeavor on our part to impress upon your minds the fact that we are in no manner 'profiteering.' Our condition today and the position we have taken regards prices of Medusa Cement is one that is deserving of your kindliest consideration.

"We trust our effort during 1921 and 1922 to date to give you at all times the 'service you deserve' will warrant on your part a continuation of present pleasant relations when we finally overcome our present difficulties."

1/3 more per dollar

Below is excerpt from a letter written by a user of Dumorite in quarry operations


"We are pleased to report
that your new dynamite called Dumorite, which we
have just tested out, seems to do the work stick
for stick against regular 40 per cent dynamite,
and as there are 35 to 40 more sticks per case,
reduces our cost 33 per cent and we will continue
to use same."

O. K'd. BY THE SEVEREST JUDGES

NO one is better fitted to judge the value of an explosive than the men in the quarries who shoot it.

We have stated that Dumorite does approximately the work of 40% dynamite stick for stick. Above is an excerpt from one of many letters from quarrymen testifying to this fact.

Remember that Dumorite gives you 35 to 40 sticks per case more than "40%" at the same price. Get in touch with our nearest branch and let Dumorite save money for you, too.

E. I. DU PONT DE NEMOURS & CO., Inc.

Branch Offices:
Birmingham . Ala. — Boston . . Mass. — Buffalo . . . N. Y. — Chicago . . . Ill. — Denver . . Colo. — Duluth . . Minn. — Huntington, W. Va. — Kansas City . Mo. — New York . N. Y. — Pittsburgh . Pa.

Explosives Department
Wilmington, Delaware .

Branch Offices:
Portland . . Ore. — St. Louis . . Mo. — Springfield . . Ill. — San Francisco, Calif. — Scranton . . Pa. — Seattle . Wash. — Spokane, Wash.

Du Pont Products Exhibit, Atlantic City, N. J.

NON-HEADACHE — DU PONT — NON-FREEZING

DUMORITE

THE LATEST OF A COMPLETE LINE OF DU PONT EXPLOSIVES

News of the Concrete Products Factories

Otto Lunborn, Manson, Iowa, operates a "Double-Speed" block machine (Wood Bros.) and a Fort Dodge mixer.

Huntington Cement Products Co., Huntington, Ind., operate Ideal block and tamper, Norwalt Vault Co's. burial vault mold and Rober & Lang mixer. Are interested in machines for making chimney blocks and building blocks also septic tanks, waterproofing compounds, marble chips and white sand for facings, truck conveyors, etc.

Allen Bros., Greensburg, Ind., operate Ideal block and power tamper, Kent continuous mixer, Little Giant brick machine, Rober & Lang sewer pipe and Heim Silo molds.

Wm. A. Morse, Pocomoke, Maryland, has also purchased unit system septic tank molds. Mr. Morse also operates Dunn tile machine and Dunn block and sewer tile molds. He anticipates a large business among the Atlantic Coast resorts in septic tanks.

The Hydraulic Stone & Building Co., Trinidad, Colo., whenever possible, draws complete elevations for jobs for which it supplies blocks. The location of every unit is marked. Openings are given a number and each block or unit that goes around that opening is given a key number. As the blocks are made they are marked, and when delivered to the job are piled near the opening for which they are intended. This saves contractor's time. The company has found that this co-operation with the architect and contractor has helped the marketing of its concrete products a great deal.

Jacksonville Concrete Products Co., Fred C. Hedrick, manager, 530 Riverside avenue, Jacksonville, Fla., operates a roofing tile and Ideal and Kramer block machines and tamper, also their own make of burial vault and sewer pipe molds and a Blystone mixer. Wants prices and catalogs on burial vault, vases, drain tile and sewer pipe molds.

Humboldt Gravel & Tile Co., Humboldt, Ia., operate a Quinn drain tile machine and an Elite continuous concrete mixer.

R. W. Young, Paulina, Iowa, wants catalogs and prices on building block and brick machines, transfer cars and facing materials.

The Concrete Products Co., Birmingham, Ala., has completed an addition to its plant and will manufacture concrete products such as porch boxes, vases, benches, bird-baths, lamp posts, all of which will be reinforced to give strength and lasting qualities. Regarding the work that is being undertaken H. B. Weiss, designer, said recently: "The plant is already in operation and we are prepared to branch out into a wide field and make an unlimited variety of designs. As most of our work is hand carved, we are able to get more than one design out of our forms, a thing that has not been possible heretofore by other concerns."

R. B. & W. H. Walters, Ora, Ind, started making concrete products, having bought a second hand outfit. Are interested in building block, chimney block, fence post and drain tile machines.

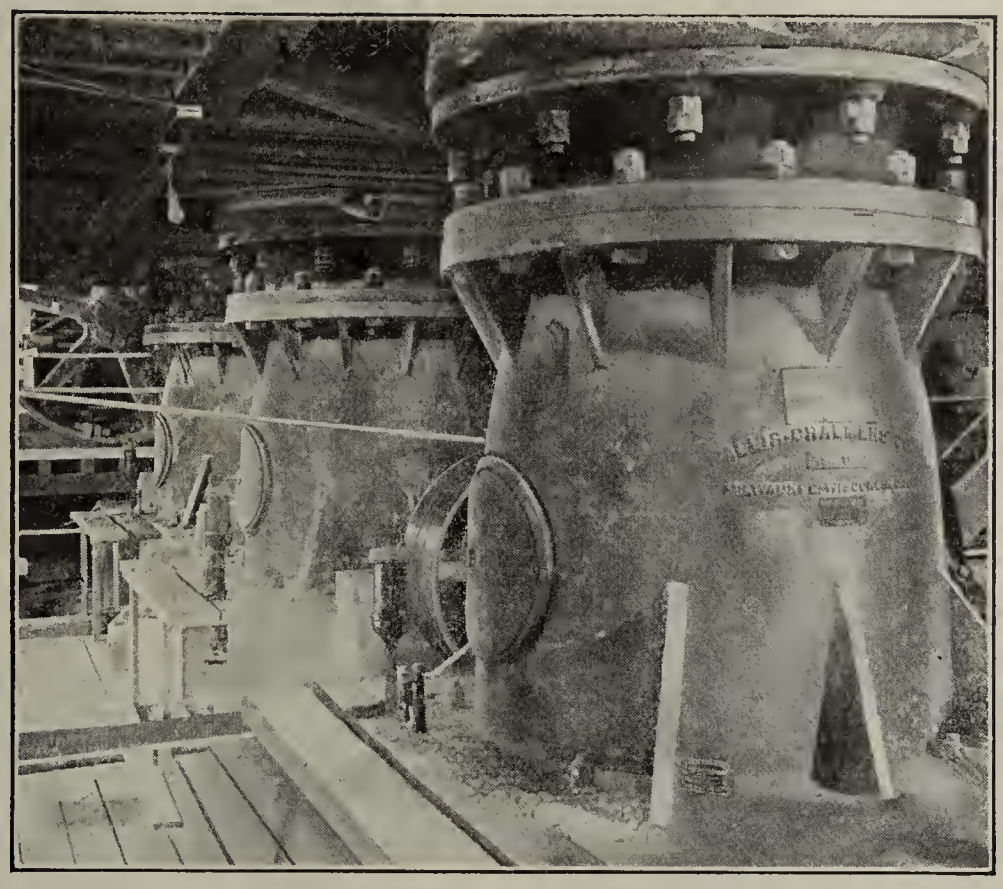
There are about 1,000 buildings including all types in and around New Kensington, Pa., built of cinder concrete building blocks. Bungalows and other small residences are stuccoed. The block are made of crushed cinders and portland cement. Contrary to a common impression, cinder concrete block are made from soft coal cinders. Cinders should be free from unburned coal and injurious acids of which the sulphur base acids are the most common and dangerous. If the cinders have weathered for several months in the open probably the sulphur is all oxidized and the resulting acids leached out. However, tests should be made to prove the cinders free from injurious ingredients.

There are 22 plants in operation at the present time making cinder concrete block. The one in Lancaster, Pa., sold close to 30,000 block in the month of March and that was generally a poor month. The block are made on nearly any kind of a machine. The Studebaker Co. made them on a Hamilton tile machine, a plant in New Kensington makes them on a Besser machine. The majority of plants use the Multiplex block machine. The stripper effect on the side of the block is very valuable in the reduction of surface pores.

The right to manufacture cinder block is covered by a patent which was issued to F. J. Straub, New Kensington, Pa., in 1917. An infringer was tried and the lower court held the patent invalid but the Superior Court reversed the decision and ordered the infringer to pay damages.

Cinder concrete block have the following advantages claimed for them. They are porous, consequently good insulators; they are fireproof; they are dry because water cannot pass through them capillarity. They are light in weight, consequently they lay up in the wall more rapidly and can be shipped at lower cost. They are resilient and consequently there is very little breakage; they cost less to manufacture.

The Los Angeles Concrete Tile Co., M. G. Watkins, president, Alhambra, Calif., writes us as follows: "The machine that makes our hollow concrete building tile is the Mouck sudden impact machine and has never been placed upon the market generally, there being but two of the machines in existence; the one we have and the other in the plant of the patentee, the Santa Barbara Unit Brick & Tile Co., Santa Barbara, Calif. We are arranging to have two more made the first of the year, as a careful survey of the machinery field has convinced us that it is the most successful building tile machine being made. It produces a wonderful unit and the product has been, and is being, used in everything from bungalow homes to mammoth factory buildings and beautiful hotel structures. Our own plant has been unable to keep up with the demand for LAC-TILE, the output being continually sold out ahead of production. We own and control the six southern counties of California and are now planning large additions and extensions. We have a Dunn machine for making concrete drain tile and we are well pleased with it."



How does your hardest drive stack up against this?

Mining men will match a gyratory crusher drive against any drive in the country for severity of belt service. In the hopper of the crusher is a huge bell weighing several tons. Under power supplied by belt this bell whirls around, smashing hard, flinty rock with the force of Thor's hammer. Every few moments it runs up against a big 14-inch rock knit as firmly as steel. Bang! There is a shivering crash. A terrific shock runs down the shaft and out to the belt. The last must not only absorb this but deliver more power to the bell to crush its victim. Some task!

Goodrich "COMMANDER" Transmission Belt has this job steadily in many of the largest mine mills in the country. If you have a pulverizer, crusher, hog drive, band saw or beater where strength and shock-absorbing qualities are a big asset, give the assignment to "COMMANDER."

THE B. F. GOODRICH RUBBER COMPANY, *Akron, Ohio*

Goodrich

Commander

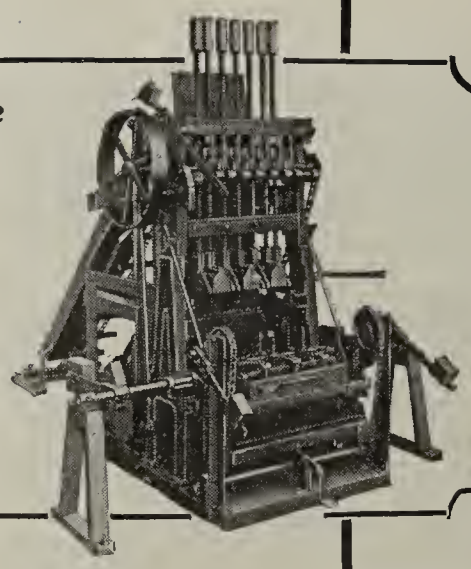
TRANSMISSION BELTS

Best in the Long Run

The Highest Type of Building Tile Machine

is represented by the Ideal Fully-Automatic. Three tile delivered on single pallet, with no stopping for off-bearing of tile.

Write today for details.



The Trade Mark of Quality

Trade Ideal Mark

More than twenty years ago Ideal machinery was first marketed —many of these machines are serving their owners faithfully today. Since then, as we have developed new efficiency devices, our original patrons have invested in them and made money thereby. They know that the name "Ideal" indicates "honor built," that every Ideal article is trustworthy and that our promise is equal to performance. Buy one of our Hand Block Machines with Tamper and as your business expands, replace it with one of our reliable Automatic Block Machines with Tamper.

The Ideal Concrete Machinery Co.
1338 Monmouth St. Cincinnati, O.

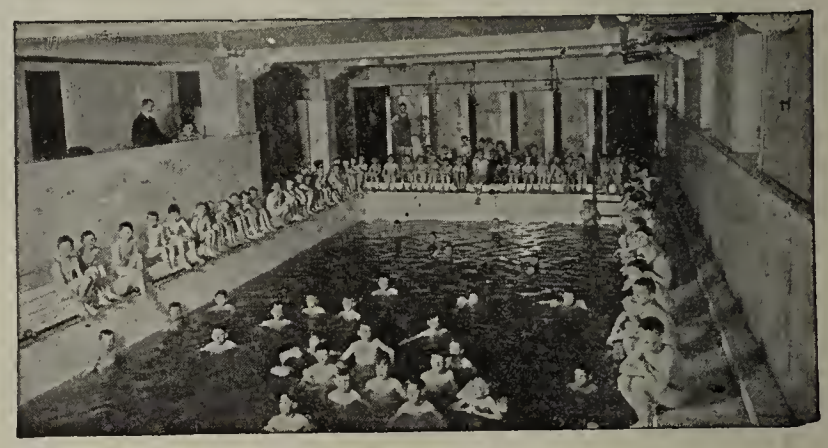
A clean-cut, graceful, strong, water proof burial vault that sells readily

THERE was a time when the manufacture of concrete burial vaults was regarded as a side-line—a specialty to utilize spare time and extra labor. But it's more than that. Often started as a sideline, with the ordinary display of enterprise, the owner finds it a year-round business, turning a definite monthly profit. The manufacturing problems are simple—the sales problems simpler still. The demand is constant, unaffected by building depressions or dull times. Our book (free for the asking) tells about the business and about our burial vault molds.

A 12-Month Business

Get This Book

Automatic Sealing Vault Co.
216 E. River St. PERU, IND.



Insured Against Leakage

Swimming pools can be made absolutely watertight and free from leakage for all time by adding 2% Medusa Waterproofing (powder or paste) to any standard portland cement lining.

Equally efficient when used to waterproof cement mortar for setting tile or marble lining.

The waterproofing forms on integral part of the whole concrete mass penetrating the pores and permanently sealing them against the seepage of moisture.

Ask for Medusa Cement and Waterproofing booklets.

THE SANDUSKY CEMENT CO.
Dept. E, Cleveland, Ohio

MEDUSA
WATERPROOFING
for **CONCRETE**

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

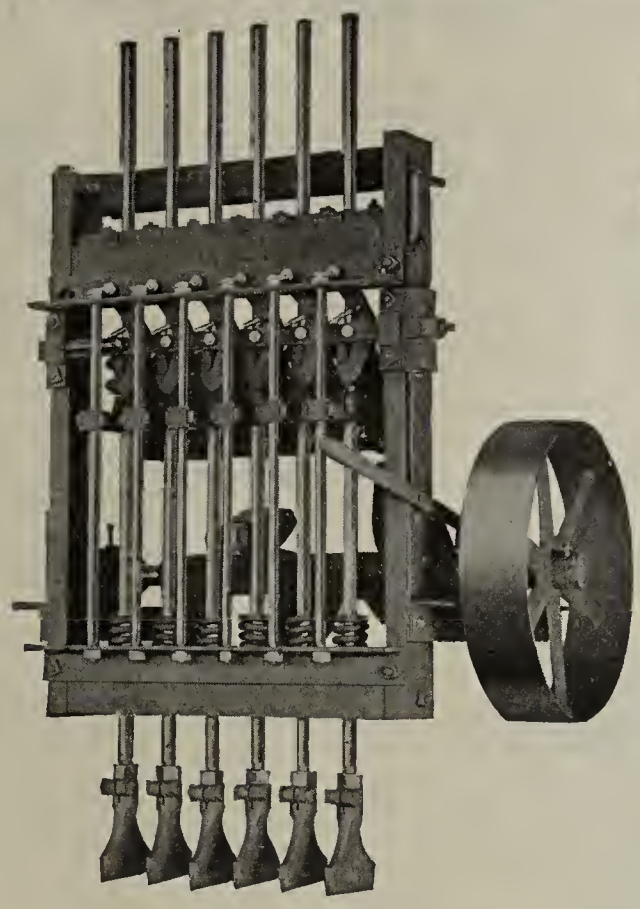
See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

THE KENT RELIABLE TAMPER



A PROVED TAMPER

Kent tampers have many times demonstrated their ability to build good will among their owners. Dramatic tests and every day grind of ordinary service furnish abundant proof of the unfailing energy of Kent tampers, and explains the enthusiastic support accorded them among concrete block, tile and brick manufacturers.

Satisfied owners is our slogan. We can satisfy you that the Kent tamper is thoroughly reliable, sturdy, compact and powerful. It is built for service and built to last. The price will interest you—due to our special facilities and unusual manufacturing advantages.

KENT JR. BATCH MIXER

A one-bag size mixer, having a capacity of from 6 to 8½ cu. yds., of loose material, depending upon the size of aggregates used. It has a very substantial truck and frame designed to stand not only the use which a concrete mixer receives, but also abuse.

RED LINE PRODUCTS

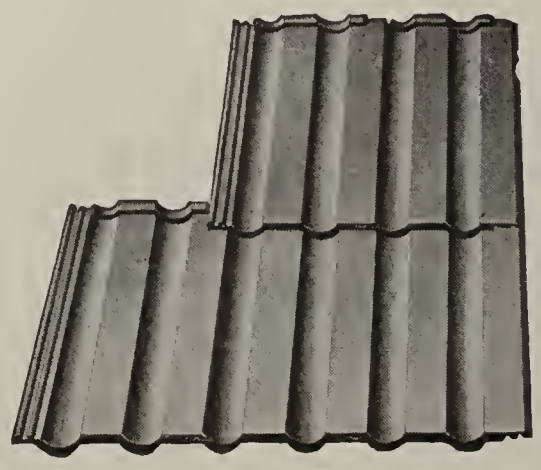
Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

KENT, OHIO

CHICAGO OFFICE, 429 Monadnock Block

YOU OUGHT TO INVESTIGATE THE SUCCESSFUL



FRENCH TILE

developments we have made in the concrete roofing tile manufacture in the way of absolutely PERMANENT COLORING and unique STRENGTH OF THE TILE, performed with our new coloring method and a peculiar pattern of the underside of the tile—specially designed for giving the tile the GREATEST STRENGTH IN ITSELF and for the purpose of REINFORCING THE TILE IF DESIRED.

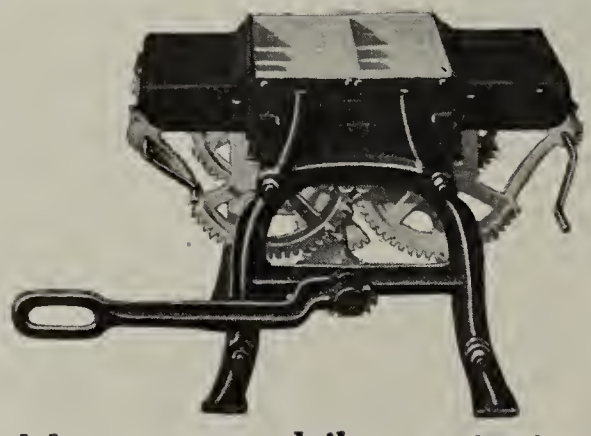
The service we give our customers is thorough and insures you of success when you are entering the concrete roof tile business—using our machines.

Write for the U. S. CHAMPION ROOF TILE BULLETIN

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.

SPANISH TILE



Double your daily output with

DOUBLE-SPEED

Brick and Block Machines

Now is the time to increase the capacity of your block plant—turn out the maximum number of wall feet per day, while the demand for building materials is at its highest.

Block Output

Our Double-Speed Block Machine makes in each operation: 2 hollow blocks, 2 silo blocks, 2 solid blocks, 2 slabs, 4 half blocks, 2 water table slabs, 2 return ends, 2 chimney blocks, or 2 porch pier blocks.

Brick Output

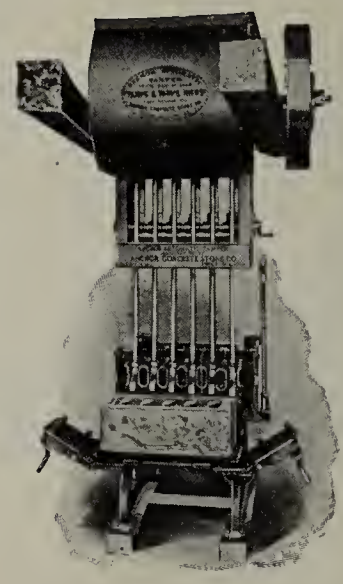
Double-Speed Brick Machine makes 16 brick at each operation, 8 brick being delivered at each side of the machine.

Double Speed Tamper

This power tamper gives our block machine a capacity of 1,500 blocks per day and speeds the brick machine up to 12,000 brick per day. Roller-cut-off removes surplus material from mold box and finishes the top of the product. The block and brick are tamped rapidly and vigorously, resulting in a dense, strong product. Machine consumes little power and is practically fool-proof.

Write for block and brick machinery catalog, Dept. A,

Wood Bros. Thresher Co. Des Moines, Ia.



THE HOBBS

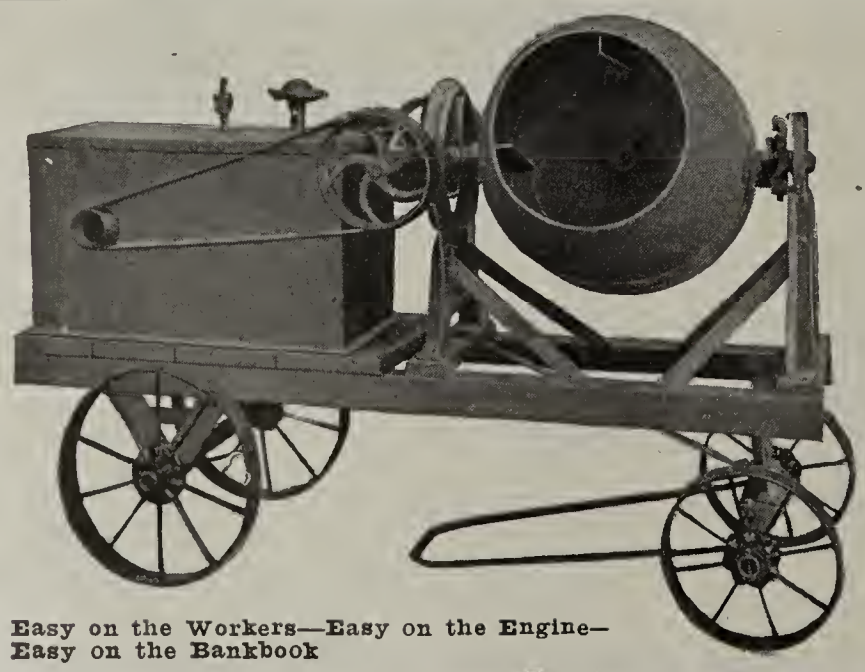
The multiple oval cores of a Hobbs machine make the use of wet mix possible with no loss of time. The result is a hard, dense, waterproof block—plain for foundations and cover walls—faced for superstructure.

For Catalogs and Prices, write

The Anchor Concrete Machinery Co.

Adrian, Mich.

Rock Rapids, Iowa; Columbus, Ohio.



Easy on the Workers—Easy on the Engine—
Easy on the Bankbook

Biggest Mixer Bargain Ever Offered

REMMEL MIXRITE Concrete Mixer

The World's Best 3½ Cubic Foot Mixer

All Iron and Steel construction with the EXCLUSIVE SIDE GEAR DRIVE, that adds 100% to its worth. Mixer loads or discharges from either side—always in gear when dumping. Strongly built—no wobbling.

The Popular Mixer for

MASON CONTRACTORS
Saves 50% in Labor

CONCRETE CONTRACTORS
Large enough for the average job and small enough to be readily moved. A Money Saver.

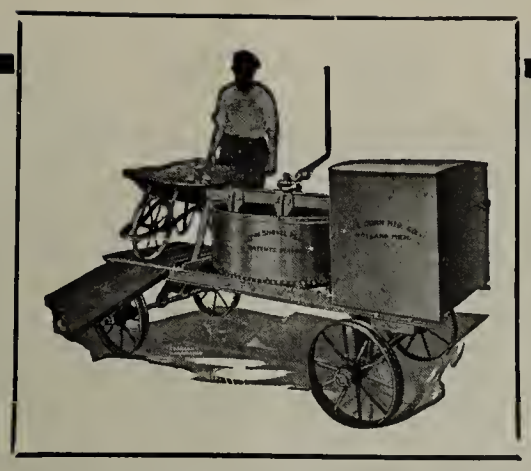
CARPENTER CONTRACTORS
Just the right size for foundations and floors.

TOWNSHIPSS
Just right for culvert and county work.

Sold Under Iron-Clad Guarantee. Write for complete specifications and descriptive circulars. Dealers wanted everywhere.

REMMEL MANUFACTURING CO.

Dept. E Kewaskum, Wis.



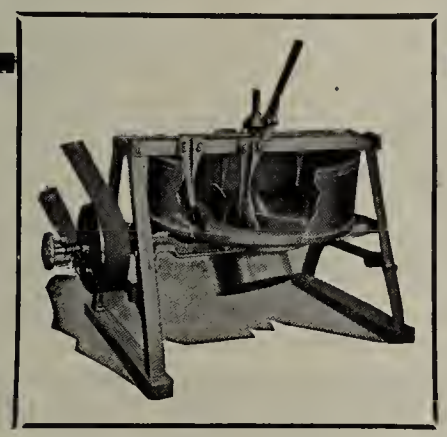
An all-round mixer for all-the-year-round work. Use it on all your concrete, mortar and plaster mixing jobs.

CONTRACTORS USE THIS MIXER ON THREE TIMES AS MANY JOBS

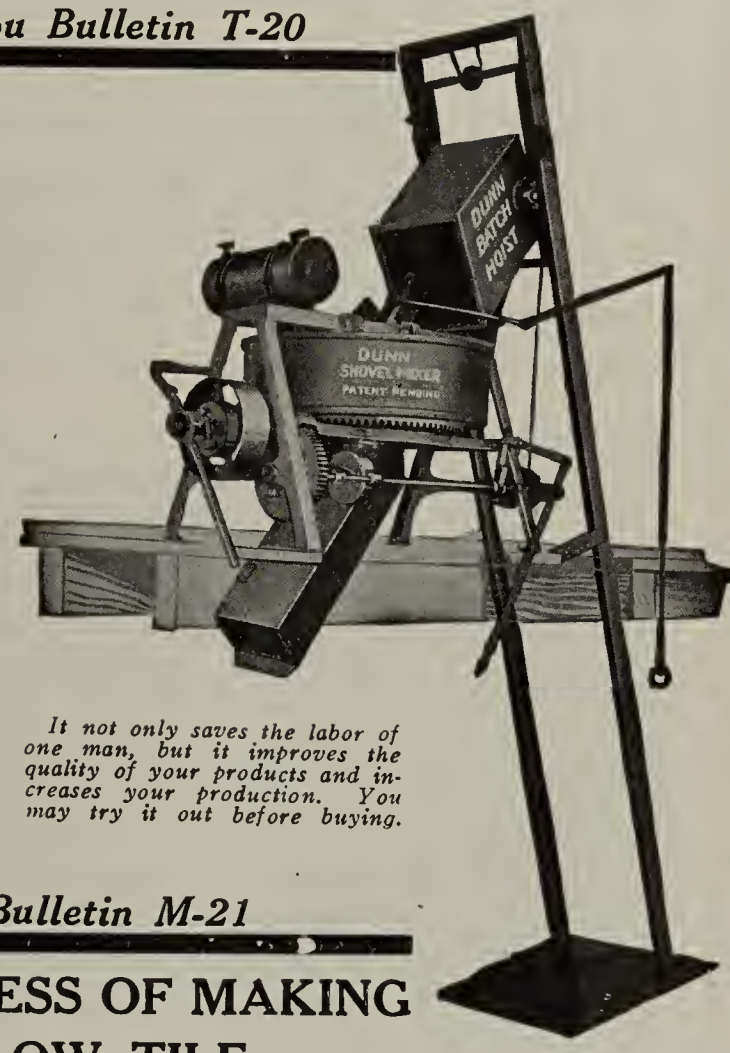
Portable Dunn Shovel Mixers are designed to mix mortar and plaster as well as concrete. They are built to do this work better than you ever had it done before. We want you to expect more service from it than from any other mixer. Don't be afraid of overworking it; keep it busy day after day on all of your mixing jobs. Even if you give it three times as much work to do as you would an ordinary mixer, it won't wear out any sooner.

You'll like the ease by which this mixer is charged, its rapid and convenient bottom discharge, the way it cleans itself, its compactness, portability, sturdiness and dependability. Because it will mix concrete, mortar and plaster and because of its many features, you really get three mixers for the price of one. And you pay no more for it than for an ordinary mixer. Try it out for a couple of weeks before you buy.

Ask Us to Send You Bulletin T-20



The Dunn Shovel Mixer produces a thoroughly mixed, plastic material because of its four shovels. A hundred times a minute the material is shoveled, stirred and troweled.

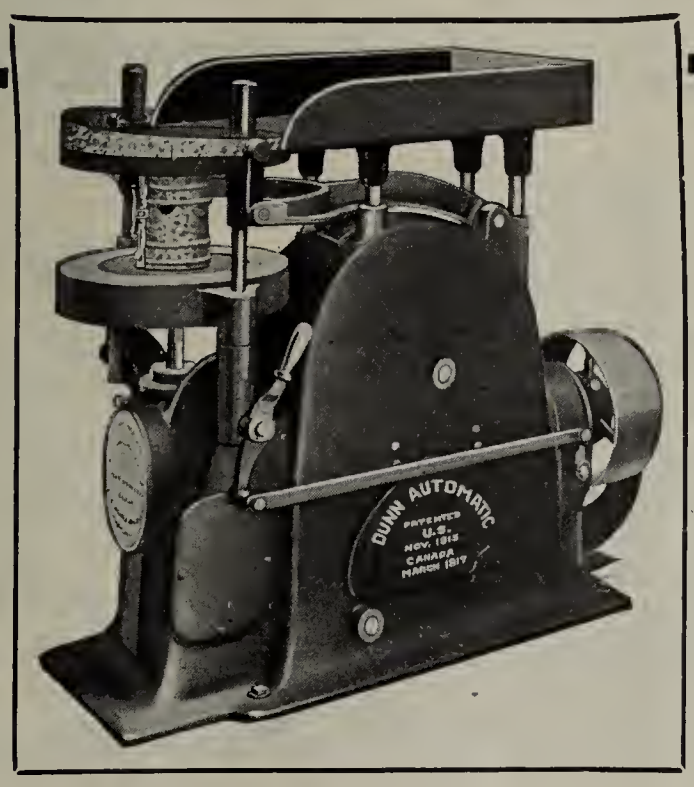


It not only saves the labor of one man, but it improves the quality of your products and increases your production. You may try it out before buying.

RUN YOUR PRODUCTS PLANT WITH ONE MAN LESS

With a stationary Dunn Shovel Mixer properly installed you can improve the quality of your products and increase your production with one man less than you are now employing. Simply because power and gravity are utilized to accomplish automatically what you are now doing by hand. The only labor involved in keeping your production machines, whatever they might be, constantly supplied with material is in loading a bucket below the floor level with the unmixed materials.

You'll be interested in knowing that the cost of this complete mixing and conveying equipment is less than that of the ordinary conveyor alone.



Write for Bulletin M-21

THE BUSINESS OF MAKING HOLLOW TILE

The immense demand and market for a more economical, more permanent building unit, such as hollow concrete tile, is readily evident in every community. Supplying this market means a permanent business bringing in large earnings.

It is a big part of our business to completely equip standardized plants for turning out this hollow tile and other products in large quantities at low cost. That we are able to establish you in a most profitable business is demonstrated by the success enjoyed by all Dunn Plant owners.

There's a whole lot to be said about this proposition which will interest you. Drop us a line for particulars.

W. E. DUNN MFG. CO.

414 W. 24th Street

HOLLAND, MICHIGAN

Concrete Roads must be reinforced

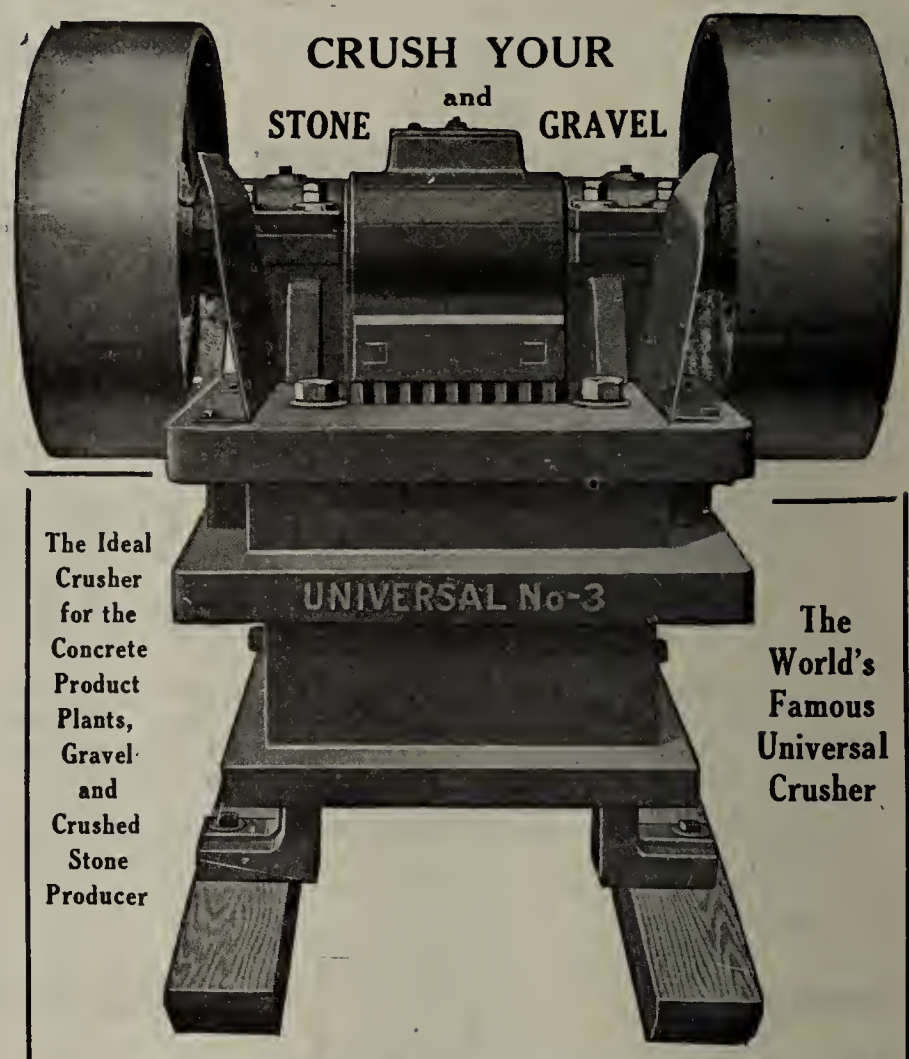
It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Company's Concrete Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

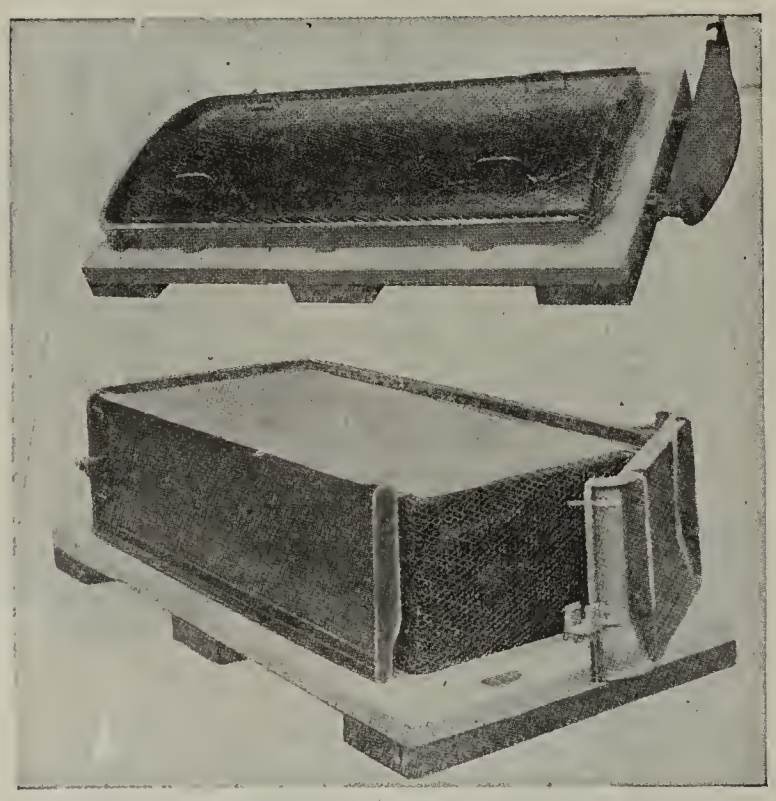
The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,



Get Into the Burial Vault Business

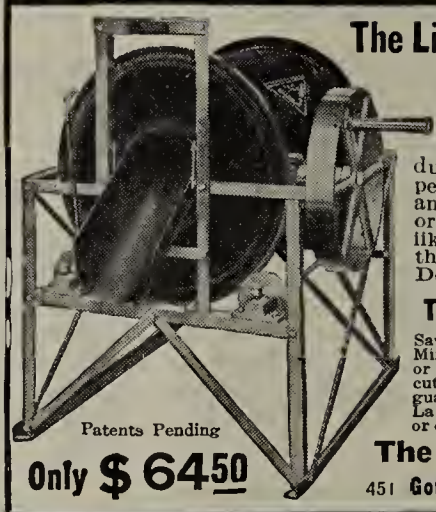
In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault, for which there is a national demand. No royalties; never a failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

CHICAGO CEMENT BURIAL VAULT AND CASKET COMPANY

5301-5-7 Ravenswood Ave. CHICAGO

ONE MAN CAN RUN IT



The Little Whirlwind Concrete Mixer
THE MASTER MIXER
From Factory to You—Save 40%

Only ***real practical*** small mixer producing same ***perfect*** work as most expensive big machine. Complete with hand and power drive. A ***winner*** for the contractor or cement worker. ***All steel and iron.*** Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forma, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delaya.

Patents Pending

Only $ 64.50

The Little Whirlwind Mixer Co.

451 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

SAVE CEMENT

Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

Write us for particulars.

Handy Sack Baler Co.
620 S. 2d St.,
Cedar Rapids, Iowa

Make More Money out of Concrete Work!

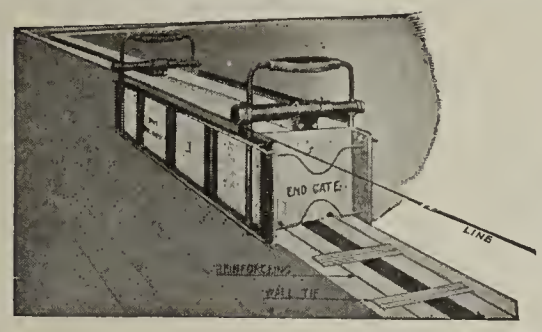
Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

For 50% Build the Hollow Wall Way For 50%



Another most perfect Monolithic Hollow Wall Bungalow built with our molds at Long Beach, Cal.

Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

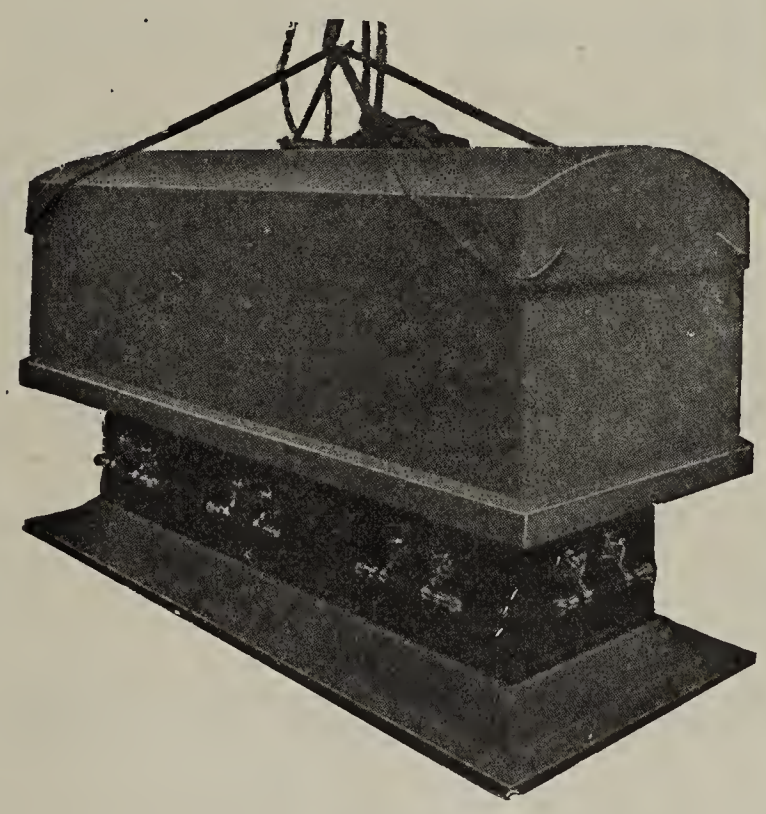
make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.



GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE"
(Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples
VICTOR BALATA & TEXTILE BELTING CO.
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston
CONVEYOR BELTS A SPECIALTY

FELSTONE

FOR

FACINGS

We are producing for the manufacturers of Synthetic Stone, Concrete Block or Brick, a material containing all the constituents of natural granite.

These are scientifically graded so as to furnish the densest possible aggregates of varying textures.

White Felstone Crystals for Stuccodash cannot be Surpassed.

The Southern Spar & Mica Company

HAYWOOD BUILDING
ASHEVILLE, NORTH CAROLINA

WHITESTONE

——FOR——

CONCRETE PRODUCTS
STUCCO DASH TERRAZZO
MARBLE DUST

We manufacture from WHITESTONE MARBLE and grade to proper sizes; Dust, Sand, Granito and Stucco Dash.

Shipments in carlots or less than carlots in straight or mixed sizes.

Bagged or in bulk.

Samples and prices on application.

Colors: White only.

NORTH GEORGIA MARBLE PRODUCTS CO.
WHITESTONE - - - GEORGIA

Every Engineer and Contractor

Should know Greenstone Dust. A material available in large quantities at a low cost. It increases the Tensile Strength of Concrete at least three times. Is a natural waterproofing. REPLACES economically the dull gray look of Concrete, and makes it a beautiful soft Olive Green.

Greenstone Dust for sidewalks, floors, concrete walks, foundations, Pillars, flower boxes, burial vaults, wherever cement is used.

SEND FOR SAMPLE, STATING PURPOSE

TRITSCHLER & SONS, INC.
220 W. 42nd St., New York City
Sales Representatives:
GREENSTONE PRODUCTS COMPANY, Incorporated

SELECTED WHITE SAND

UNEXCELLED FOR

Facing Concrete Blocks, Ornamental Concrete Stone, Hard Plaster, Finishing, Exterior Plastering, Roofing, Stone and Marble Sawing, etc.

Prices, Freight Rates and Samples on Application
Shipped in Paper Lined Box Cars
Small Shipments in 175-lb. Bags

Ottawa Silica Company

OTTAWA, ILLINOIS

Big Money in

UNIT SYSTEM SEPTIC TANKS

For exclusive territory and molds write

WM. DE LHORBE, Oregon, Ill.

MAKE YOUR OWN

FADELESS CEMENT COLOR

GREEN, BLUE, YELLOW, ETC.
Install such department in your Cement, Brick or Tile Plant, full particulars upon request.

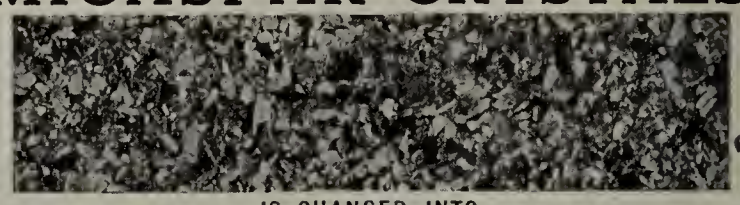
J. ENDLER, Chemist

1014 W. 87th St. Chicago, Ill.

CONCRETE

BRIDGES, BRICKS, BLOCKS, BUILDING TRIM, POSTS, ORNAMENTAL WORK, CAST STONE, ETC.
WHEN TREATED WITH

MICASPAR CRYSTALS



IS CHANGED INTO

A SPARKLING GRANITE FACE

BEAUTIFUL, ARTISTIC AND EVERLASTING

Adds to your product a selling value five times greater than the facing cost.

Made in six scientifically milled sizes, extremely hard, sharp and free from dust and impurities. Insures strength and beauty. Booklet, "Micaspar and How to Use It," with free samples, mailed on request.

Crown Point Spar Co., Inc., 101 Park Ave., N. Y.

Cement and Engineering News

Vol. 34 Chicago, NOVEMBER, 1922 No. 11

Portland and Other Cements in 1921

The final figures of the output of portland cement in 1921, compiled by the United States Geological Survey from reports from all producers, show that the production was a little less than 99 per cent of that in 1920, the record year.

Estimates of the production and of the shipments of portland cement in 1921, published late in January, 1922, summarized from the estimates issued monthly by the United States Geological Survey during the last half of the year, were only about 0.6 per cent and 0.5 per cent, respectively lower than these final figures.

The exports of hydraulic cement from the United States in 1921 were 1,181,014 barrels, valued at $4,276,986, or $3.62 a barrel, as compared with 2,985,807 barrels, valued at $10,045,369, or $3.36 a barrel, in 1920. The exports were sent principally to the West Indies, South America, Mexico, and Central America.

The imports of consumption in 1921 were 122,322 barrels, valued at $388,842, or $3.18 a barrel, as compared with 524,604 barrels, valued at $1,254,729, or $2.39 a barrel, in 1920.

The statistics of exports and imports were compiled from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Amount of Water Used in Making Concrete

Do you know that no other single factor has so great an effect upon the strength of concrete as has the amount of water used?

Thousands of tests conducted at the Structural Materials Research Laboratory, Lewis Institute, Chicago, prove that a direct relation exists between the quantity of water used in mixing concrete and the strength of the resulting concrete. These tests mean money to the builder because strength is what he is after.

A variation of ten per cent above or below the correct amount of mixing water may reduce the strength of the concrete by thirty per cent or more. The very wet, sloppy mixtures that are sometimes used in building construction result in a loss in many instances of from fifty to sixty per cent of the possible strength of the building.

Within the range of plastic mixtures, the strength falls off rapidly with the addition of a small amount of superfluous water; in a one-bag batch the addition of even one pint of water more than is necessary to give a workable mix results in the same loss of strength as if from two or three pounds of cement were left out of the mixture. That's money out of the pocket for the builder.

The exact amount of water required for any particular mixture of aggregates to obtain the greatest strength in the concrete can be determined, only by actual test. Workability of the mixture is important and must not be sacrificed. As a basis for trial with well-graded aggregates up to 1½ inches in size, and a 1:2:4 mix, use 6 to 6½ gallons of water per sack of cement. For a 1:2:3 mix begin with 5¾ to 6 gallons, and for a 1:1½:3 mix, 5½ to 6 gallons. Remember: Use the least amount of water that will give a workable mixture.

Integral Waterproofing of Concrete

A reprint of the *Discussion on Integral Waterproofing of Concrete,* submitted by R. A. Plumb to the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, has been issued by the Truscon Laboratories, Detroit, Mich., for distribution among those who have technical interest in the subject.

The paper defines porosity and gives a theoretical discussion of waterproofing cement and cement mortar together with data of tests tending to prove the author's theory. A statement of the effects of water on concrete under practical conditions, is also included.

Exceptions are taken to Technologic Paper No. 3 of the Bureau of Standards, on the grounds that tests on a few ineffective compounds should not be the basis of a wholesale criticism of integral waterproofing.

The results of laboratory tests on samples that show a marked reduction in absorption due to the integral presence of a water repellant compounds are outlined.

The results of various investigations to determine the attitude of engineers, architects and contractors towards integral waterproofings, that show a majority of those responding to inquiry to be in favor of this proposition, are included.

As a technical man who has made a long and thorough study of his special subject, Mr. Plumb may perhaps be open to criticism for his use of the term "porous" in relation to concrete throughout the discussion. "Porous" is of course a relative term. The *extent* of its porosity is the determining factor. To control that *extent* of porosity as required by the work in hand, is the problem of the engineer, in solving which he may adopt any one of several means, either with or without special admixtures, as the service of the work requires, and as the relation of the available materials to the economy of the job may indicate.

Cement Sack Losses

Ward P. Christie, Research Engineer of Associated General Contractors, Tells How to Eliminate This Cost Item From Concrete Work.

The loss of cement sacks on a construction project is generally recognized by contractors as an important cost item of the concrete work, but it is frequently regarded by others as a result of carelessness, which should be eliminated. While wide variation from average loss might be charged to improper handling, all cement sacks have a limited life, at the end of which construction must pay over to the cement industry an amount for each sack lost or made unserviceable. To ascertain this average loss and to throw some light upon the allowance which should be made in a construction estimate to cover its expense, the Research Department of the Associated General Contratcors has obtained data on the subject from the records of cement manufacturers. These records, which have been carefully kept over a period of years, enable approximate determination of the following items:

1. Average number of sacks lost or destroyed.
2. Average number returned but rejected at the mills.
3. Average number of trips per sack.

From the record of the number of sacks lost or destroyed and the number rejected at the mills is deduced the average number of trips per sack. This deduction is based upon the average replacement required. Thus if eight per cent of the sacks sent out over such a period are not returned and if two per cent are rejected at the mills the average replacement is ten per cent and the average indicated number of trips per sack is ten.

Records from the different companies show no great variation over a long period, though obviously the return from individual sales does vary within wide limits. On small-lot sales, which constitute some fifty per cent or more of all sales, the return of sacks is low. A farmer buying three sacks of cement for the foundation of his hen house often finds good use for the sacks and does not return them, whereas, an efficient road building plant may succeed in effecting almost a perfect return. Between these extremes is room for great variation, but, speaking for major construction projects where a maximum return of sacks occurs, the variation is within much narrower limits.

The percentage of sacks rejected also shows but slight variation, though some variation is due to the personal judgment of the inspectors, who allow greater or less latitude at different times. Sacks are rejected on account of unsatisfactory condition caused by ordinary wear and tear, setting of cement in the fabric, and tearing. A clean tear or rip, however, is usually accepted. Of all sacks rejected those that have become wet constitute by far the greatest number.

Records of the Vulcanite Portland Cement Company, kept since 1903, show an average return of 89 or 90 per cent, but in recent years this average has dropped to about 85 per cent. In addition to the 15 per cent thus lost in the field, approximately two per cent are rejected by inspectors. Thus the amount lost, destroyed and rejected, for which contractors must pay, according to this company's records is about 17 per cent. This indicates an average of six trips per sack.

Records of the Lehigh Portland Cement Company over a seven-year period show an average loss of between 14 and 17 per cent, or an average of between six and seven trips.

The Universal Portland Cement Company's records show the highest return noted, which average 90 per cent or ten trips per sack. This high rate is attributed by the company principally to its educational campaign among cement users, who have been supplied with information relative to the best methods of handling sacks and preparing them for shipment.

During 1920 the records of the Canada Cement Company showed that their sacks averaged 2½ trips per year and that the average life was 6.8 trips. Other companies, who requested that their names be withheld, show a total return of sacks varying from 80 to 90 per cent, or a variation between 5 and 10 trips per sack.

In order to spread information as to the proper care of cement sacks and to insure the return of as large a proportion of them as possible, instructions similar to that printed below, are sent out to users of Universal cement. Compliance with these instructions, it is believed, has helped to reduce materially the loss and damage of sacks.

Rules to be Observed by Men Handling Sacks.

I. Value of Cloth Sacks.

1. A carload of sacks is worth several carloads of cement.

2. Gross prices of Universal cement packed in cloth sacks includes charge for sacks, which remain Universal property and are leased to purchasers of cement. Sack charge is refunded in full to original purchaser of cement for such returned empty sacks are are in good or repairable condition when received at Universal's plants.

3. Storing large numbers of empty sacks ties up money that earns no dividends.

II. Parties Involved.

1. Railroads handle hundreds of car-loads of sacks. They cannot be expected to have the same interest in one bundle as a shipper.

2. Manufacturer handles millions of sacks a year. He is anxious to give prompt credit.

3. Shippers can reduce tedious delays to a minimum by observing rules of railroads and following suggestions of manufacturers.

III. Railroad Rules Specify That

1. Bundles must be tied with three separate wires or ropes. (If rope is used it must be not less than 3-16 inch in diameter.)

2. Freight must be prepaid to destination.

Note.—Placards for placing in warehouse contain summary of railroad's rules and manufacturer's recommendations. If your sopy is mislaid, write for another.

IV. Tags.

1. Must contain name and address of consignee.
2. Must contain name and address of shipper.
3. Must contain name and address of party to whom credit is to be issued.

V. Linen Tags Furnished by Universal.

1. Front bears Universal's name and address and contains blanks for date of shipment and for shipper's and creditor's names and addresses.

2. Reverse side has blanks to show total number of bundles and sacks in shipment.

3. Complete filling out of blanks makes issuing of credit easy and simplifies sorting of thousands of individual shipments.

4. Every carload of Universal has ample supply of tags in "Loading Envelope."

5. More Universal tags will be sent on request.

VI. Credit.

1. Bundles must be identified before credit can be issued.

2. Card, letterhead or extra filled out tag inside of bundle ensures of identification even if outside tag

be lost in handling, provided that bundle reaches destination intact.

3. Failure to send bill of lading delays credit, as shipment often is delivered before railroad furnishes proper billing.

4. Tags properly filled out on both sides show immediately: a. Number of sacks in shipment. b. Name of shipper. c. Party to be credited.

Concrete Drain Tile in Alkaline Soil

Limits to the use of concrete tile in alkaline soil are indicated by a report of investigations made in southwestern Minnesota by the State Department of Drainage and Waters in co-operation with the U. S. Department of Agriculture. This report was made by Dalton G. Miller, senior drainage engineer, under the direction of S. H. McCrory, chief of division of agricultural engineering, U. S. Department of Agriculture. An abstract of the findings of the report is given below.

The real trouble is in extreme conditions of the soil in contact with the tile rather than the salt content of water flowing in the tile. The danger limit of the soil water is about 3,000 parts per million when the salts consist almost wholly of the sulphates of magnesium, sodium and calcium, with the first two near 66 to 75 per cent of the total. The most pronounced failures have occurred where the total salt content has exceeded 4,500 parts. It has been concluded that the sulphates are in a large measure directly responsible for the failure.

Characteristic failures are by disintegration beginning with a checking and cracking of the exterior surface of the tile wall, followed by an increase in volume. Finally all binding principles of the cement disappear and the mass resembles a freshly-mixed batch of lime-mortar concrete. Of the exact chemical processes much remains to be learned, but the final result in extreme cases is a loss of most of the cement. There is no known solution for the problem but betterment in quality of the tile will minimize the difficulty in that the danger limit of the sulphate waters can be raised considerably. Until it is possible to make concrete that will definitely resist all action of sulphate waters, concrete tile should not be considered where soil analyses indicate sulphates in more than nominal quantities.

Except where disintegration has resulted from the action of sulphates, concrete tile are giving satisfactory service throughout the area covered by the investigation. Physical tests indicate that the general quality of concrete tile manufactured in southwestern Minnesota during 1919 and 1920 was high enough to meet the requirements of the drain-tile specifications of the American Society for Testing Materials. Tile manufactured previous to 1919 was somewhat inferior in quality to that now being made.

To secure better concrete tile the following suggestions are made: (1) Use only properly graded clean sand that is free from organic matter; (2) more coarse aggregate; (3) more attention to the consistency of the mix, which means a wetter mix at nearly all the plants; (4) more care to regulate the time of mixing so that there is more uniformity with respect to different batches and also to insure that each batch is thoroughly mixed; (5) curing the product before it leaves the tile plant. Attention is directed to the almost negligible quantity of aggregate retained on the quarter inch screen. As this material represents the only course aggregate it is evident that these tile should properly be called "mortar tile" rather than "concrete tile." There is no indication that any of the mixing waters used are objectionable.

German Colorings for Cement

The production of colored articles in cement mortar or concrete has always been somewhat unsatisfactory, and many façades which had a pleasing appearance when new have rapidly deteriorated and become unsightly. This applies especially to concrete tiles.

Reds.—The best red colors are produced by red bole, a natural oxide of iron whose tint has been developed by levigation and calcination. It is largely used as the basis of red oxide paints.

Several varieties of iron oxide are available, they vary considerably in composition, according to the amount of combined water present. The color does not appear to be directly related to the chemical composition, but rather to the size and density of the particles.

One of the best forms is a by-product in the manufacture of sulphuric acid from calcined pyrites, but for use with cement it should be free from sulphurous acid, which is a common cause of scum and discoloration.

Yellows.—Ochre is the chief material used for the production of a yellow color in cement work. It is a weathering product of ferruginous felspar and of very variable composition. It is usually kept for several years in the open, then ground and levigated so as to separate coarse impurities. Umber is a darker color, but in many respects similar to ochre. Both ochre and umber reduce the strength of the cement mortar or concrete.

Zinc yellow (zinc chromate) is sometimes used as a yellow pigment, but its price is generally too high for its extensive use in concrete or cement work.

Blacks.—There are two chief sources of black pigment suitable for use with cement, namely manganese black and carbon black. Manganese blacks consist chiefly of manganese dioxide, while carbon blacks consist of slate, black shale or some form of soot, such as lamp black.

Ground coke is also largely used as a black pigment. All these materials must be particularly finely ground. Usually manganese black is more serviceable than carbon black, but is more costly.

Green and Blues are made from ultramarine with some other pigment, such as chromium oxide, ultramarine increases the strength of the cement on account of the free (colloidal) silica and aluminum present which gives it hydraulic properties.

The best green pigment for cement mortar is chromium oxide prepared from a mixture of potassium bichromate and sulphur, it should be bought as its preparation is difficult.

Lime green is a magnesium alumino silicate (augite) containing some iron and of a very variable composition. Most green cement mortars or concrete fade on account of the oxidation of the iron present.—*Zement,* translated in *Concrete and Constructional Engineering,* London.

The Production of Molding and Silica Sand for Glass Making

Over thirty-seven years ago, Mr. E. M. Ayers of Zanesville, Ohio, started the operation of sand pits near Zanesville, Ohio. The business prospered and grew steadily until in 1904 the company was reorganized under its present name, The Ayers Mineral Company, to operate six plants in all, four of which produce molding sand for iron casting, sold to a wide market from New England to the Mississippi River, and two a fine grade of silica sand for glass making and steel molding.

The largest of these plants is near New Lexington, Ohio. The plant, which is the subject of this article, has a mill capacity of 400 tons daily. Until six years ago the sand was mined by hand and trapped with slip scrapers as is done in many hundreds of plants over the country today.

Mr. E. M. Ayers, however, realized that through the use of a steam shovel, a Plymouth gasoline locomotive, his costs could be considerably reduced, and his operations greatly simplified and quickened. His cost of production at this time averaged 15c per ton.

Three years ago, therefore, this Company purchased a revolving shovel, equipped with a ⅝ cu. yd. dipper. The shovel was mounted on caterpillar traction.

The operation is extremely simple. The caterpillar mounting of the shovel enables the machine to be moved about the pit quickly and easily with the minimum of ground men. In fact the shovel operation itself requires but an operator for the shovel, a fireman, and one ground man.

No stripping is required, the shovel loads 4 ton steel rocker cars, which are hauled 2,000 feet to the mill by a Plymouth gasoline locomotive. According to Mr. Ayers, the cost of operation has been reduced about one half with a possibility of increasing the output considerably over the present mill capacity of 400 tons, if it is so desired in the future.

At the mill the material goes through a centrifugal pulverizer and a wire screen to an elevator, from which it is carried up on a 24-in. belt feed to a storage bin with a capacity of 1,500 tons.

E. M. Ayers is directly in charge of operation, ably assisted by C. O. Beckett as superintendent. Mr. Ayers is president of the American Sand Association.

Sand Pit of the Ayers Mineral Company, New Lexington, Ohio. The shovel loads 4-ton rocker cars hauled by Plymouth gasoline locomotive 2,000 feet to the mill.

Powdered Coal

Grindle Powdered Fuel Equipment, is the title of an interesting, illustrated booklet recently issued by the Grindle Fuel Equipment Co., Harvey, Ill. Pp. 40; 8½ x 11 in.; illustrated. The advantages and savings, both in cost and labor, obtained by the installation of the Grindle system are interestingly told, as are also its operation and some of the uses to which it can be adapted.

Waterproof Cement Paint

Sandusky Cement Co., Department E, Cleveland, Ohio, has recently placed on the market the "Medusa waterproof cement paint," which is unaffected by lime and alkalies in portland cement or moisture, which causes rapid deterioration of oil paints. Medusa paint freshens the appearance, fills and covers cracks in stucco and give a bright, clean appearance to the surface. It has been produced after years of experiment and is made on an entirely different principle from oil paints, being a dry powder which is designed to mix with water on the job. It mixes readily and forms a perfect emulsion with water and spreads smoothly and easily. The presence of moisture both while the paint is being applied and thereafter serves only to increase its tenacity, strength and hardness, instead of preventing perfect adhesion. Medusa comes in the form of a dry powder, 10 lbs., which is mixed with 2½ qts. of water. It is made in colors white, cream-buff and stone gray, at present, though the company expects to add red and green and other colors shortly. This paint will prove a boon to all owners of stucco houses, as it will enable the owner to freshen up the house at moderate cost.

Aggregate Strength No Measure of Concrete Strength

Tests Show That for Texas Materials Compression Value of Concrete Is Independent of Coarse Aggregate

By F. E. GIESECKE
Head, Engineering Research Division, University of Texas, Austin, Tex.

It is generally believed that the strength of concrete depends partly on the strength of the matrix, partly on the bond between the matrix and the aggregate, and partly on the strength of the aggregate. In order to ascertain the extent to which the strenth of concrete is determined by the strength of its coarse aggregate, a series of tests has been undertaken by the Engineering Research Division of the University of Texas. The results of the 28-day and 3-month tests of this series indicate that, for the materials tested, the strength of concrete is almost independent of the strength of its coarse aggregate.

Speaking generally, the coarse aggregates studied in this investigation cover practically the entire range from the hardest to the softest aggregates available in Texas for concrete construction.

The characteristics of the coarse aggregates studied are shown in Table I. The test speciments were 2 x 4-in. cylinders. The aggregates were Colorado River sand, and crushed rock of two sizes, the smaller size passing a ¼-in. mesh sieve and retained on a ⅛-in. mesh sieve; the larger size passing a ½-in. mesh sieve and retained on the ¼-in. mesh sieve.

TABLE I—CHARACTERISTICS OF COARSE

Name	Crushing Str. Lb./Sq.In.	Spec. Grav.	Per cent Wear	Hard-ness	Tough-ness
A. Trap Rock	33,600	3.13	1.00	18.34	32
B. Porphyry	27,800	2.66	1.94	18.9	16
C. Dolomite	25,500	2.8	2.98	14.65	12
D. Medium Limestone	19,000	2.62	3.3	11.3	6.5
E. Medium Limestone	10,300	2.58	4.92	11.34	6.5
F. Soft Limestone	4,400	2.03	8.72	0	2.0

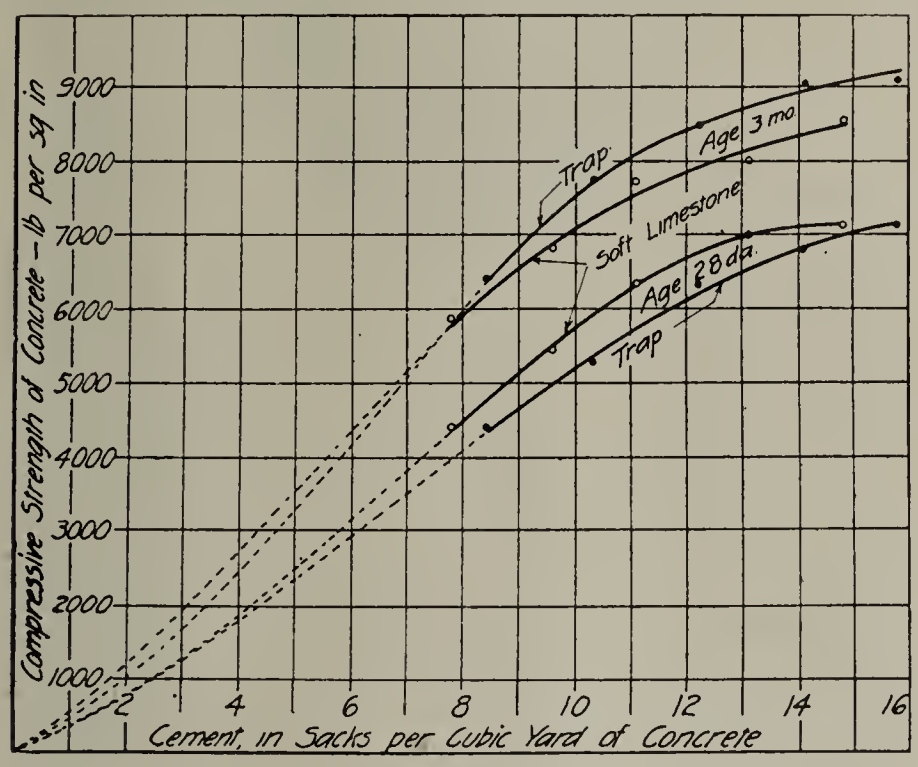


Figure 1

Showing the strength of concrete made with soft limestone and of similar concrete made with trap rock. Each of the 20 points represented in the diagram is the average of five experimental determinations.

posed, by weight, of one part of the smaller size to two parts of the larger size.

The cement was a blend of Texas cements which passed the standard specifications and had a tensile

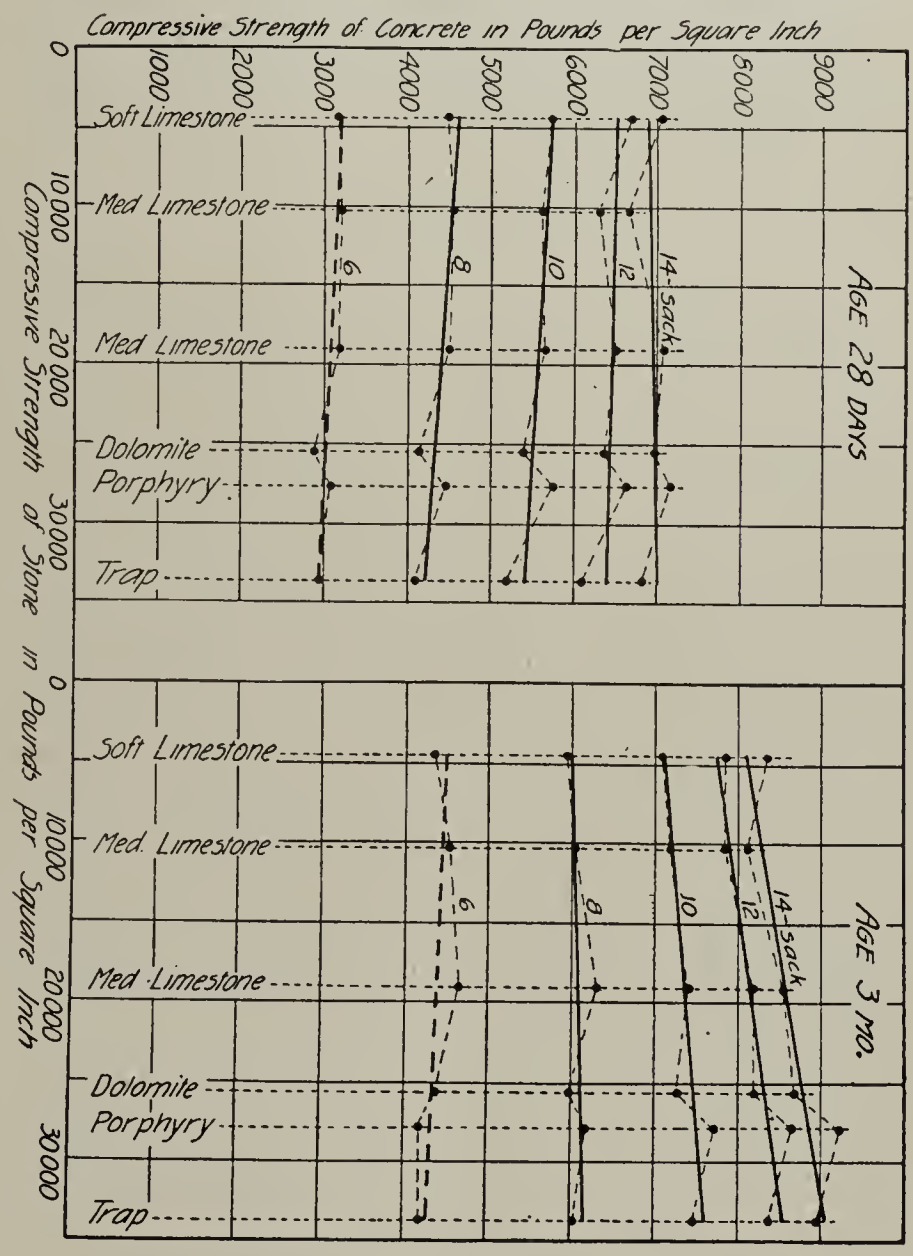


Figure 2

Showing the variation in the strength of concrete with the richness of the mix, with the strength of the coarse aggregate, and with age, as determined from curves like those shown in Figure 1, the coarse aggregate being not larger than one-half inch.

The aggregates were compounded, by weight, so that one volume of sand was used with every two volumes of crushed rock; the crushed rock was compounded, by weight, of one part of the smaller size to two parts of the larger size.

The cement was a blend of Texas cements which passed the standard specifications and had a tensile strength of 282 lb. at seven days and 360 lb. at twenty-eight days. The cement was proportioned so that the richness of the mixes varied from about eight to about fifteen sacks of cement per cubic yard of concrete.

The two principal reasons for using such rich mixes were that the hard rocks are better able to develop a strong concrete in a rich mix than in a lean one, and that aggregates of the small sizes need richer mixes to develop ordinary strengths than larger aggregates.

The total mixing water used was equal, by weight, to 23 per cent of the cement, plus 8 per cent of the sand, plus 4 per cent of the crushed stone. In order to make proper allowance for the difference in the quantity of water absorbed by the different kinds of crushed stone, the following method was used: Imme-

diately before preparing a mix, the crushed stone was immersed in water for 15 minutes and then centrifuged in a Rotarex Extractor for 70 seconds. By this method the crushed stone had no surplus water on the surface and was saturated sufficiently not to extract water from the mix. As well as could be judged by the appearance, the consistency was the same for all mixes.

The series consisted of 300 test specimens: it included six different aggregates and five different proportions of cement for each aggregate, ten specimens were made for each aggregate and each proportion of cement, five to be tested at 28 days and five at 3 months. The five specimens constituting a group were made on five different days in order to avoid accidental variation which might affect the whole group.

The average of the 28-day and 3-months tests are shown in Table II and for two of the materials are given in Fig. 1 and from curves such as these for all

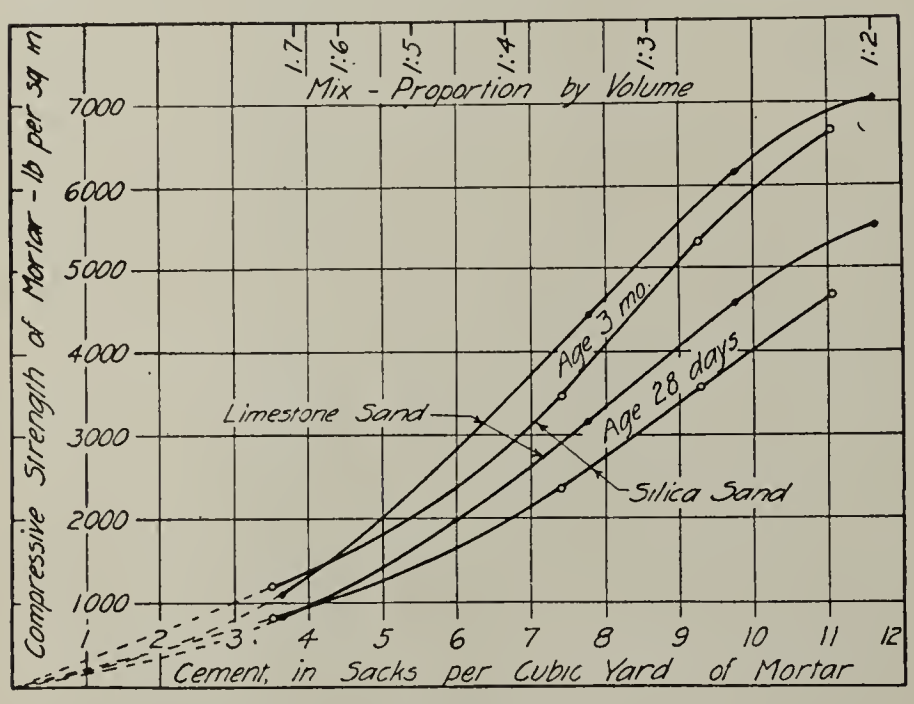


Figure 3

Showing the compressive strength of limestone sand mortars and silica sand mortars at ages of 28 days and 3 months. Each of the points shown in this diagram is the average of five experimental determinations.

the specimens the strengths for mixes of 6, 8, 10, 12, and 14 sacks of cement per cubic yard of concrete were obtained and plotted against the ultimate compressive strength of the coarse aggregate (Fig. 2).

FIG. 2. RELATIVE CONCRETE STRENGTH FOR DIFFERENT AGGREGATES

TABLE II—COMPRESSIVE STRENGTHS OF CONCRETE WITH DIFFERENT AGGREGATES*

	(7.81)	(9.60)	(11.12)	(13.15)	(14.84)
A.....	5,871	6,828	7,704	8,004	8,536
	(8.04)	(9.93)	(11.70)	(13.64)	(15.23)
B.....	6,307	7,051	7,845	8,135	8,070
	(8.01)	(9.87)	(11.66)	(13.59)	(15.21)
C.....	6,306	7,358	8,116	8,458	8,625
	(7.99)	(9.83)	(11.68)	(13.47)	(15.15)
D.....	5,970	7,189	8,104	8,603	8,721
	(7.85)	(9.73)	(11.55)	(13.35)	(14.9)
E.....	6,003	7,574	8,488	9,035	9,378
	(8.44)	(10.36)	(12.25)	(14.12)	(15.80)
F.....	6,408	7,733	8,467	9,049	9,072

* The figure in the parenthesis is the cement in sacks per cubic yard of concrete. The lower figure is the strength of concrete in pounds per square inch.

It is evident from this figure that, for the materials tested and for the proportions of cement ordinarily employed in practice, the strength of concrete varies only slightly with the strength of its coarse aggregate. For very rich mixes and high ages the strength of concrete increase slightly with the strength of its coarse aggregate, but for ordinary mixes and an age of 28 days, the strength of concrete made with comparatively weak limestone aggregate is as high or higher than that of similar concrete made with the strong igneous rock aggregates.

The explanation of this remarkable result may be that as the strength of the stone increases, its surfaces become smoother, and, consequently, the bond between the matrix and the aggregate becomes weaker: and that the loss in strength of the concrete due to the weaker bond is about equal to the increase in strength due to the higher strength of the coarse aggregate.

However, since in this investigation the maximum size of the coarse aggregate was only ½ in., the relative volume of the coarse aggregate was less than it is in ordinary concrete, and it is possible that the strength of the coarse aggregate had a correspondingly smaller influence on the strength of the concrete. This phase of the problem will be studied in another series of tests.

The reader should understand clearly that this investigation relates only to the compressive strength of concrete and not to the resistance to abrasion.

Acid-Proofing and Hardening of Concrete

The chemical division of the U. S. S. Lead Refinery, Inc., 120 Broadway, New York, N. Y., is producing a new solution for the hardening and acid-proofing of concrete surfaces. The manufacturing operations, are carried on at the company's lead refinery located in East Chicago, Ind. This solution has been a product of intense interest to manufacturers of chemicals particularly those industries where acids or oils enter into the processes mainly because the tests made up to the present time and still under way show that ordinary concrete is rendered practically inactive to acid solutions and oil.

The concrete surface at the time of each treatment must be free from dirt, oil or grease, and must dry and set at the first instance of application. One part of proofing solution is diluted with two parts of water and applied with a brush. After allowing to stand for 24 hours, the second coat is put on, consisting of equal parts of proofing solution and water. This is allowed to stand 24 hours and a third coat is applied, consisting of two parts of proofing solution to one part of water, when the concrete is very porous a fourth application of straight proofing solution is recommended.

At the completion of the process the surface is dried and flushed with water.

When the solution is thus brought in contact with the concrete, it precipitates acid-resisting compounds in the pores of mass causing the new surface to become an entirely different chemical composition from the original concrete, this effect penetrating to a depth of about one-eighth inch. This new surface chemically formed is hard and flint-like in structure and is not attacked by acids solutions or oils. It is also very hard, being resistant to wear, as when put on concrete floors.

It is now in use on floors subjected to acid slops at the Willard Storage Battery Co., and is being considered by a number of chemical firms for the construction of acid tanks. Should it prove successful in the latter case, the benefit to the chemical engineer over the present method of lining these tanks or silos with acid-proof brick is obvious.

A complete series of tests on all the acids is now under way at the Research Laboratory of the U. S. S. Lead Refinery, Inc.

John B. Foote

Born April 6, 1865,
Died Oct. 12, 1922

His many friends and acquaintances will be deeply shocked to learn of the death of John Bergoyne Foote. Mr. Foote who was president and treasurer of Foote Bros. Gear & Machine Company was known all over the country not only for his skill as a gear maker and inventor for transmission and other machinery and for his keen interest in anything that would further efficiency in machine operation but because of his many acts of helpfulness to others not so fortunate as he.

Just two days before his death, Mr. Foote presided at a banquet given by the American Gear Manufacturers Association, in which he was a very active member. Mr. Foote was the pioneer in making cut-steel, case hardened, tough cored gears for heavy duty work. He was one of the first to invent and build enclosed types of transmission for reducing electric motor speeds. He shared with Henry Ford the

honors of pioneering the present light weight type of farm tractor and in this connection he was the inventor of the enclosed transmission and live axle drive. He was also the inventor of numerous automatic machines for making cans and was regarded as a foremost authority on special machinery.

But not only was Mr. Foote interested in everything that made for greater industrial efficiency; he was intensely interested in all things that tended toward the betterment of humanity. His many charitable acts both to friends and strangers testify to his great, broad mind and generosity.

John B. Foote was a true Chicago product and a self made man. He began at the age of 14 as a die setter for the Chicago Stamping Co., and was made foreman of the press stamping room of the Cragin Mfg. Co. when only 17. Successively he was die and tool maker for Norton Bros. (now the American Can Co.); superintendent of machinery for Cragin Mfg. Co.; in charge of the machine shop of the American Co.; and designer and builder of special machinery for Fisher Manufacturing Co.

From 1893 to 1904, John B. Foote was a partner with D. O. James in the firm of James & Foote, manufacturers of cut gears. In 1904 a disastrous fire wiped out all but the goodwill of the concern. Then he organized Foote Bros. Gear & Machine Company, which speedily became one of the biggest and best known gear concerns in the country.

John B. Foote was also a director of the Barton Spider Web Re-Enforced Concrete System; president and director of Illinois Tractor Co.; treasurer of American Tractor Association; director of American Gear Mfrs. Assn.; member, Society of Automotive Engineers, Illinois Athletic Club, Oak Park Elks, and treasurer of Butterfield Country Club, Oak Park, Ill.

Mr. Foote was buried at Mount Carmel Cemetery on Monday, Oct. 16. He is survived by his widow, Aimee W. Foote, and his brother, Bradford Foote, who will continue the business of Foote Bros. Gear & Machine Company, 213 N. Curtis St., Chicago, Ill.

To Avoid Variable Concrete Due to Variable Sand Wetness

New Method of Mixing Proposes Inundating Sand Before Dumping in Mixer Thus Keeping Moisture Content Constant

By R. L. BERTIN, Chief Engineer, White Construction Co., Inc., New York City

Variable moisture content of sand is responsible for a large part of the variation in the strength of field concrete. Not only does the changing amount of water, due generally to atmospheric conditions, affect the bulk of the sand and thereby the amount used in the mix but it makes it extremely difficult to gauge the proper amount of water to add in order to get the optimum concrete.

In attacking this phase of the problem of proportioning concrete there has been evolved what is thought to be a practical method of measuring sand and water regardless of the moisture content. This method, which has been developed after a considerable amount of experimentation, should result in the elimination of such variables as are the direct cause for the lack of constancy in the absolute quantity of materials contained in successive batches of concrete. An extended series of tests is about to be made with the view of getting more definite information, but the present status of the development seems worth noting.

It is a well known fact that the volumetric measurement of sand with varying moisture content is no gauge of the absolute amount of sand measured or the amount of water carried by this variable amount of measured sand. Measurements by weight while giving closer results lack constancy to the extent of the variation in moisture content. The problem which presented itself was to find some method of measuring sand containing any percentage of moisture in such a way as to insure a constant known amount of given sand and constant amount of water contained therein in successive measures, irrespective of the moisture content of the sand as measured.

Two methods of making the water content constant suggested themselves. One was to dry the sand, which is considered impracticable, and the second was to inundate it with water; in other words, fill the voids completely with water.

The next step, which was thought probable and later proved by a series of tests, was to determine whether a given sand in an inundated condition has a constant void factor. The basis of this belief was the

fact that if surface tension were done away with in damp sand by inundation, the bulking effect would disappear and therefore a fairly uniform ratio be obtained between weight and volume. It was found experimentally that if sand be poured in a container partially filled with water, the amount of water therein contained being in excess of that required to fill the voids, until the sand and water level have reached the top of the container, a fairly constant weight of sand and water was contained therein, so long as the specific gravity and void factor of the sand remained constant or nearly so. The only two disturbing factors which it was thought might interfere with the accuracy of the measures, were first, the absorption of the sand, and second, the air entrapped within the voids of the sand. However, since only the constancy of measurement was sought, it was thought and verified that these factors would not vary much, and would not affect the constancy of results.

The coarse aggregate carries a certain amount of water, but it was found that by keeping the stone pile wetted that this amount of water was small and fairly uniform and that no compensation was necessary since there was but a slight variation.

Sand and Water Container.—A container was then designed based on the above principles, a description of which follows:

The container is cylindrical in shape and divided in two vertical sections, the upper intended to contain the right amount of inundated sand required for a batch, and the lower section the complement of water required beyond that contained in the inundated sand and the wetted stone to supply the total amount required for the batch. The two bottoms are made adjustable so as to permit of changes in capacity in the event of variations in grading or voids of the aggregate, or proportions of mix requiring changes in the sand and water quantities. The intermediate bottom is provided with fine screens to permit the water to enter therein and exit therefrom.

In operating the container, it is first partly filled with water, the lower container being completely filled and the upper container to a point so that enough water is provided to more than fill the sand voids. Sand is then dropped into the water contained in the upper section until it is filled to the top with inundated sand, the excess water spilling over the top sides. The container is then emptied into the mixer hopper, thereby delivering to the mixer known amounts of sand and water which are constant from batch to batch.

A number of preliminary tests were conducted with the view of ascertaining the practicability of the method described above and the accuracy of results obtained. In making these tests a certain proportion was adopted and the sand was used in different condition as to moisture content, from perfectly dry to saturated. The materials which were used were of one kind for all tests.

Conclusions.—The observations and conclusions derived from these tests are as follows: (1) The amounts of water and sand in successive batches are practically constant; (2) the plasticity of the concrete produced as determined by the slump tests shows only slight variations; (3) the cement factor in successive batches is nearly constant; (4) the amount of concrete in each batch measured by volume or weight is nearly constant; and (5) the strength of the concrete tested at 28 days is fairly uniform.

If the conclusions noted above are proved to be facts by the tests, the method promises a solution of the problem of specifying of concrete by strength which has been recently proposed.

Comparison of Steam and Compressed Air Operation of Shovels

Its complete operation by compressed air is the unique feature of the 30B Bucyrus shovel installed at one of the quarries of the Union Rock Co. of Los Angeles. A 12x14-in. single-stage Sullivan air compressor is used which delivers about 430 cu. ft. per minute at 250 r.p.m. The compressor is driven by an 85-h.p. d.c. motor operated by power from a d.c. transmission line. Air from the compressor is delivered to a receiver tank having a volume of 250 cu. ft. Approximately 1,000 ft. of 3-in. pipe carries the air to the shovel at the far end of the tunnel, which is 500 ft. long. Air enters the machine through the water pipe on the steam machine.

While this operation has been found satisfactory, still the present compressor capacity is small; there is difficulty in keeping the air pressure up to the proper point. Under continuous operation the air pressure drops to about 70 lbs. per sq. in., and the shovel does not act as quickly as when the pressure is kept between 90 and 100 lbs. As the shovel is not loading continuously, this is not a serious difficulty.

Considerable saving has been effected by the Union Rock Co. over the cost of operation of a steam machine burning fuel oil, the usual equipment on the Pacific coast. Under such conditions—where cheap power may be had and oil must be burned because of the high cost of coal—the saving effected is shown in the following figures taken from the *Excavating Engineer*:

STEAM OPERATION		
Fuel oil—4 bbl. per day at $2.50 per bbl	$ 10.00	
Fireman at $4.50 per day	4.50	
	$ 14.50	say $ 15.00
Monthly cost (26 days)	$390.00	say $400.00
COMPRESSED AIR OPERATION		
Power at $1 per h.p. per month	$ 85.00	
Half salary of compressor operator	65.00	
Maintenance and repairs on compressor	25.00	
	$175.00	

Saving per month, $400—$175. = $225.

It should be noted that the air for the drills in the quarry is supplied by a separate, independent compressor requiring but one man's attendance. As the same man takes care of both compressors, only half of his wages is charged to the shovel. The item of $25 per month for compressor maintenance is high. There is practically no boiler depreciation—the boiler really is in better condition than if it were idle as oil is carried into it and deposited on the tubes.

This quarry's entire output is used in Los Angeles, delivered by truck. The rock is used mainly for concrete for roads and other construction.

A Correction

Referring to the interesting article in the October, 1922 issue of CEMENT & ENGINEERING NEWS on pages 26, 27 and 28 we failed to mention that Victor J. Milkowski, engineer for the Morris Machine Works, manufacturers of the famous Morris dredging pump, Baldwinsville, N. Y., is the author of this article.

Sage Foundation Building Concrete Houses at Forest Hills

One of the best examples of the architectural and economic possibilities of concrete houses built up with large standardized sections may be found at Forest Hills, Long Island, where the Sage Foundation Homes Co. is erecting a number of unit-built concrete houses.

These structures are the result of the efforts of Mrs. Russell Sage to provide modern, sanitary and attractive homes at a cost which the man of moderate means can afford to pay. In pursuance of this plan, Grosvenor Atterbury, a New York architect, spent three years prior to 1911 in developing an architectural style suited to large standard reinforced concrete units, with the idea that large sections of walls, floors and roofs could be assembled in different ways and proper variety obtained. This, he believed, would make possible the construction of high-class homes on a quantity production basis, through the use of modern construction equipment and methods. At the same time the Unit Construction Co., of St. Louis, collaborated with Mr. Atterbury, acting as engineers on all matters of structural design and developing complete methods of unit construction, consisting of the casting plant, erection equipment and construction organization necessary to successful operation. Many other concrete houses and business buildings had previously been built at Forest Hills by ordinary construction methods. The experiments of 1908, 1909 and 1910 were made i nan attempt to eliminate the excesssive cost of form work and the waste resulting from lack of standardization. During this time three unit-construction houses were actually built as a test of the practical application of the system. Following this first experimental work, fourteen more houses, built in groups of three or four, were erected prior to 1915.

As a result of the experience gained, and the growing appreciation of the architectural appearance, sanitary qualities and moderate cost of concrete houses, the Unit Construction Co. was given contracts for six additional houses in 1917 and ten in 1919. Each of these groups was built in one block, sometimes called the terrace type of construction, with solid party walls between houses. The Unit Construction Company's equipment and casting yard were taken over early in 1920 by the Standardized Housing Corporation, of which M. P. McArdle is local manager. During the summer of 1920, three large 8-room detached houses were built, each with two baths, for the purpose of getting complete and detailed cost data for estimating future construction costs.

One of our illustrations shows the attractive architectural appearance of the ten houses built in 1919. The construction methods used reduced concrete house building to a quantity production basis without the los of good architecture. The slabs are large reinforced concrete sections of walls, floors, ceilings and roofs, weighing from one to three tons, which are cast, cured and finished in a central casting yard. The sections are cast in steel forms in a head-house, protected from the influence of weather changes, after which they are stacked in the curing yard and later

These Eight-Room Houses Were Built by the Standardized Housing Corporation in 1920 to Obtain Exact Unit Costs on Which to Base Estimates for Future Construction.

The Sage Foundation Homes Co., Forest Hills, Long Island, N. Y., Obtained an Attractive Architecture for a High-Class Suburban District Through Concrete Construction.

transported to the building site as needed, on small 12-ton, mule-drawn, industrial railway flat cars.

The interior surfaces of the sections are then brushed over with grout and rubbed down to a smooth finish suitable as a ground for the subsequent interior decoration. The scrubbing is done with stiff fibre or wire brushes. Exterior surfaces are first scrubbed a few hours after they are cast. Two days later they are washed with acid to brighten the exposed aggregates. The under side of floor slabs is cast with a smooth finish, and is usually decorated with heavily stippled paint after erection. All this finishing work is done while the slabs are resting on the false bottoms of the forms, and while the concrete is still fairly green. As soon as the units are sufficiently hardened to be handled without the aid of false bottoms, they are placed on the flat cars and taken to the curing yard.

At the building site in an electric crane lifts the slabs directly from the flat cars to the final position in the building. The time required for placing a section in position, lining it up true and wedging it up for prouting, it about twenty minutes. The sides of the wall sections are tongued and grooved and the joints between sections are grouted, so that the entire structure becomes in fact a monolith.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of Cement & Engineering News, published monthly at Chicago, Ill., for October 1st, 1922.

State of Illinois. } ss.
County of Cook. }

Before me, a Notary in and for the State and county aforesaid, personally appeared John F. Waldron, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Cement & Engineering News, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, I. M. Seafert, 22 Quincy Street, Chicago, Ill.; Editor, E. S. Faussett, 22 Quincy St., Chicago, Ill.; Managing Editor, E. S. Faussett, 22 Quincy St., Chicago, Ill.; Business Manager, John F. Waldron, 22 Quincy St., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) I. M. Seafert (sole owner), 22 Quincy St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is— (This information is required from daily publications only.)

John F. Waldron.
Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1922.

Frank W. McVicker.

(Seal) (My commission expires April 1, 1924.)

Hollow Wall of Concrete*

By A. S. Greene

We claim our molds to be the simplest, lightest, and most perfect in the world, and with them can be built about 20% more wall than with molds of other make. One yard of gravel and one barrel of cement will make 22 cu. ft. of concretee, or 33 sq. ft. of double 4-in. wall with a 2-in. air space between them, or 38 sq. ft. of double 3½-in. wall, etc., ready to rough cast on the outside and plaster on the inside.

While our walls are far superior in every way to a concrete block wall, I will compare the cost in the following manner:

COMPARISON

Concrete Block—First they haul the gravel and cement to the block factory; there it is mixed and placed in the molds, released from the mold and set back to dry; then placed on a wagon or truck and hauled to the building site and unloaded. Now they get their lime and sand and mix the mortar, after which they are all ready to place them in the wall.

By using our molds—The cement and gravel is hauled directly to the building site, and the very next time it is handled it is placed in the finished wall. In other words, a cement block wall is handled nine times as against our walls being handled twice. Which means less work, more profit, and better satisfaction.

The prices quoted in our circular are net, F. O. B. our Factory, and the Company requires a deposit of 10% with the order to cover railroad charges; where the entire amount is sent with the order, you may deduct 3%. Bear in mind our molds are sold under a positive guarantee to do all our literature claims for them.

---

*Universal Cement Mold Co., North Milwaukee, Wis.

Concrete Houses Built Without Forms

At Leeds, Ala., some concrete cottages were recently constructed without the use of forms. These were built by the Donaldson Concrete Construction Company, of Birmingham, to house employes of the Standard Portland Cement Company. Considering the fire-resistive and maintenance-free qualities of concrete, cost of these houses was very low.

The Donaldson system produces what may be described as a reinforced concrete structural framework with walls formed by plastering and back plastering on metal lath. The columns, beams and floors are

A Donaldson System Concrete House at Leeds, Ala., Built Without Forms at a Cost Less Than for Impermanent, Frame Construction.

cast in place using metal lath as forms. The concrete is of a stiff consistency to prevent its loss through the meshes of the wire lath. The outside wall is then formed by fastening metal lath to the columns and beams, and plastering cement mortar on both sides to give a total thickness of about 2 inches. The inside wall is also plastered on metal lath which is spaced about 3 inches from the outside wall, thus forming an air space between the 2-inch outside wall and the plastered interior finish. Floors and ceilings are of con-

Group of Donaldson System Concrete Houses in Housing Development for the Standard Portland Cement Co., Leeds, Ala.

crete cast in place without forms. In constructing the floors of the houses at Leeds, "Self-Sentering" was supported at intervals and the concrete for the floors and ceilings placed directly on it. The metal lath acting as forms for the beams was bent down into the floor slab forming coved corners all around the rooms. Ceilings are finished by plastering on the metal lath which acts as forms for the concrete floor or ceiling slabs.

Accompanying illustrations of the concrete houses at Leeds were taken about the time the cottages were completed, and before the grounds had been cleaned up and improved. After that is done and judicious use is made of vines and shrubbery, the employes oc-

Two Houses at Leeds, Ala., in Contrast: the New Donaldson System Concrete House in the Foreground, and the Old Frame Type of Construction which it Replaces, in the Background.

cupying these concrete cottages will find themselves in very attractive homes.

The Donaldson Concrete Construction Company obtained the contract for these cottages because their bids were lower than those of frame construction.

Vacuum Grave Vaults

Recently Geo. Ziegele, 215 Broadway Ave., Peoria, Ill., a concrete block manufacturer, embarked upon an enterprise that promises to rival in importance the manufacture of concrete building units. Previous to this spring he has been manufacturing concrete burial vaults as a side line. The venture proved profitable but as a practical concrete worker Mr. Ziegele believed that the design of the vault he was manufacturing could be improved.

He conceived the idea of making a vault which would have the joint between the upper and lower sections at the bottom of the vault instead of at the top, as is the usual practice. In this way the air, trapped within the vault when it is lowered, effectively resists the entrance of water into the vault even though the joint between the upper and lower sections may not be perfectly sealed. In this design an air seal is effected.

Mr. Ziegele now controls the patent on the Vacuum grave vault which makes use of this principle. He is selling the all-steel, adjustable molds used in its manufacture and is licensing operators throughout the country. Wherever the Vacuum grave vault has been introduced it has met with instant approval. One of these vaults can be submerged, open end down, and the interior will remain dry much as an inverted empty drinking glass can be placed under water without wetting the interir. The Ziegele vacuum grave vault is highly attractive in appearance, the upper flanges facilitate handling and it is impervious to moisture.

Opportunities in the precast concrete field are almost limitless. The manufacturer of one or more types of products can usually find another that can be profitably handled in conjunction with his existing line. Burial vaults are growing in popularity and the manufacturer of concrete building units will frequently find that their addition to his line of products will result in increased profits.

Explosives and Blasting*

Important Relation of Explosives to the Economical Operation of Stone Quarries—Description of High Explosives and Modern Methods of Firing

Some of the most important qualities in the selecting of an explosive for quarry use are—strength, sensitiveness, stability, velocity or rate of detonation, ability to resist water and density. Upon the proper combination of these characteristics depends the adaptability of an explosive to the work at hand.

Strength is of prime importance, but a low-strength explosive is often better adapted to and will give more satisfactory results in some classes of work than one of high strength. Almost any strength is obtainable. The straight and ammonia types of dynamites may be had in all strengths from 15 up to 60 per cent. When it is necessary to use a higher strength gelatin dynamite must be used; it is manufactured in all strengths from 25 to 100 per cent.

The degree of sensitiveness is also of great consequence, for it is essential that an explosive be so sensitive that full detonation and maximum efficiency can be got out of it by the standard detonator, yet not be so sensitive that it becomes dangerous in ordinary handling and in transportation. Safety is also a prime consideration, and the balance of sensitiveness between efficiency and safety is one of the features which makes necessary expert knowledge and skill in manufacturing explosives.

Again, stability is highly important. No one wants an explosive that it liable to go off spontaneously during storage; that becomes more or less sensitive with age; that is affected by ordinary temperature changes.

Velocity of detonation or speed with which an explosive develops a maximum pressure must also be considered. This quality varies greatly with different explosives. Where great shattering is desired an explosive with a high rate of detonation should be used, but where a heaving or rending action is required, a slower one is better adapted.

Some explosives will not resist water for any length of time, while others are almost unaffected by water; some are light and bulky, while others are heavy and dense. All these factors must be considered when deciding the explosive best adapted for a piece of work.

The manufacture of explosives is a highly scientific business, involving the maintenance of many trained chemists and engineers to assure the purity of raw materials, balance of ingredients in the formula and exactness in plant processes to produce explosives meeting the widely different conditions found in actual work and be uniform, stable and safe. American explosives manufacturers are today turning out a wonderfully efficient product.

Determining the Proper Explosive

It is sometimes a problem for the quarryman to determine the most economical and efficient explosive. Conditions vary so much in actual practice and there are so many different explosives made that it often requires considerable experimenting to arrive at the one best suited for the work. Explosives men, with a wider experience than any one operator can easily have, are always willing to co-operate and to assist the consumer in selecting the most economical and efficient explosive.

Many things must be considered in determining the proper explosive to employ—kind of quarry, whether pit, side hill or cliff; nature of the material, hard or soft, tough or brittle, limestone or trap, direction of strata, thickness of ledges, height of face or benches, method of drilling and loading, size of crusher, purpose for which the stone is used and whether the work is wet or dry. The system of drilling, the method of handling the stone and the selection of the explosive are more or less interdependent and are in turn influenced to a great extent by the height of the face, hardness and stratification of the stone, size of the crusher and output desired. While no hard and fast rules can be laid down to cover all operations, in quarries of the same class similar methods and explosives can usually be recommended.

The explosives generally used in the United States quarries are straight nitroglycerin, dynamites, extra or ammonia dynamites, gelatin dynamites, nitrostarch powders and, to a lesser extent, the comparatively recent type of explosives—light and bulky and marketed under various trade names. Straight dynamite, the original high explosive, is the standard against which all other explosives are measured. Straight dynamites are still generally considered the quickest and most shattering, although gelatin dynamites, when confined, are just as quick as and sometimes quicker than the corresponding grades of straight nitroglycerin dynamite. Gelatin dynamites are also the densest and heaviest commercial explosives and will resist water indefinitely, standing first in this respect.

Gelatin dynamites, unless under confinement, are relatively slow in action and should not be used for such work as mudcapping. The extra or ammonia dynamites are made by combining nitroglycerin, nitrate of ammonia and other explosive ingredients. They are slower in action than the corresponding grades of straight dynamite and will not resist water so well, but they have many desirable characteristics which make them well suited for general use in quarry work. As a rule, they are cheaper and safer to handle than other kinds. More ammonia dynamite is used in all classes of work than all other kinds put together. The nitrostarch explosives consist of nitrated starch mixed with nitrate of soda and nitrate of ammonia; they contain no nitroglycerin, are slower, more hygroscopic and less sensitive than the nitroglycerin compounds. Judson, or R. R. P., powder is a crude black powder, the grains of which are coated with nitroglycerin. It is well suited in tunnel or gopher-hole blasting in quarries, in sprung holes for removing lighter materials or where something stronger and quicker than black powder is desired. It is not suited to wet work.

Blasting Cost.

In figuring blasting cost too much stress is generally laid upon the cost per pound of explosive rather than upon the cost per ton or yard of rock. The only way of arriving at a true cost and a true measure of explosive efficiency is by calculating the number of tons produced per pound, and by considering the shape in which the stone is produced and the other significant factors in the operation. Almost anyone can go into a quarry and reduce the explosive cost per ton. Either by using a cheaper priced or a lower grade explosive, or by arbitrarily cutting down the loads per hole, one may move just as many tons of stone per

*Paper delivered by S. R. Russell of the Du Pont Powder Co., at annual convention National Crushed Stone Assn.

pound. Successful and economical blasting does not mean merely moving or throwing down so many tons of stone; it means throwing down the material in proper condition, consistent with the equipment for handling and the purpose for which it is to be used and with due regard for the after costs, as secondary blasting, loading, track movements and crushing. A lowering in the shovel efficiency on account of difficult digging caused by poor blasting, with consequent increase in shovel repairs, will far outweigh in cost any slight decrease in explosives cost per ton of stone. Frequently the use of a higher strength or different kind or greater quantity of explosive in the primary blast has resulted in a lower ultimate cost per ton.

It is not the price per pound of the explosive that is so important, but the cost per ton or yard of stone produced; not even the explosive cost per yard of the material as blasted but the final cost on the cars, which includes drilling, blasting, loading, transportation, crushing, overhead, etc. Blasting affects every item in the cost analysis and if it is not properly done, the cost of each subsequent operation will be higher than it should be.

Here is an actual case typical of many. The company was called upon by a large concern to visit one of their quarries where for some years they had been getting rather poor results. The costs were high and the output not commensurate with the plant capacity and equipment. They were using well drills and drilling 40 to 45 ft. holes, 5 5-8 in. in diameter. Many of the holes were very wet, a 40-ft. hole sometimes containing 20 ft. of water. They were using a dynamite unsuited to wet conditions and cartridges 4 in. in diameter. The blaster naturally was afraid to break the cartridges and expose the dynamite directly to the water; consequently, they were loaded intact one on the other. The result was that the explosive could not be concentrated in the bore hole. The three steam shovels were working on an average of between 40 and 50 per cent capacity. It was not uncommon for a shovel to be held up four or five hours on account of drilling and blasting bottom. The drilling was rather carelessly done and the spacing for 45-ft. holes was 6 ft. apart and 12 ft. back—very close spacing for limestone. We changed over to gelatin dynamite, increased the size of the cartridges to 4½ in. in diameter, reduced the drill-bit gage to 5 1-4 in. and made certain that all holes were drilled 5 ft. below the grade. After two years' trial, there is rarely any trouble with bottom, the shovel efficiency has jumped to 70 per cent, and two shovels are handling what it formerly required three to do. The spacing of holes has been widened to 8 ft. apart and 15 ft. back. The quarry is in better shape, the output greater, and the cost per ton less, notwithstanding the explosive now in use costs more per pound than the one formerly employed.

The drilling also was at fault and the explosive used was too light and otherwise unsuitable. The density of an explosive is very important in some quarries. If the bottom is hard or irregular, and there is no distinct parting at the floor of the quarry, it is absolutely necessary to concentrate the explosive charge at that point. This can be accomplished by completely filling the bore hole, by using a high-density explosive, or by drilling a sufficient depth below the floor grade. If much water is present it is almost impossible to pack the granular type of dynamite, hence a gelatin dynamite in cartridges with a diameter nearly as large as the hole is required.

Proper Drilling Methods.

Proper drilling depth is of the greatest importance. Holes are not generally drilled deep enough below grade. To be sure of the proper depths it is advisable to run a line of levels over the floor and on top of the quarry face, establishing permanent bench marks and setting reference stakes at various stations around the face for the drill man. These stakes should indicate the depth to which the holes should be drilled. This little item alone may be worth a great many dollars to the quarryman in a season.

The use of large diameter cartridges is advisable in loading deep-well holes and manufacturers can furnish dynamite in all sizes up to 5 in. in diameter. Large cartridges lighten the labor of loading and permit a greater bore-hole density of the explosive in the bore hole. When large cartridges are used, very little tamping, often none at all, is necessary. Tamping here does not mean stemming. If holes are dry, the cartridges should be slit lengthwise two or three times and dropped or lowered into the hole. The fall causes the powder to spill out, practically filling the hole. Slitting the cartridges is not advisable when water is present. Do not hurry the work in loading explosives in quarries, especially in large holes, but furnish enough help so that loading will go on with dispatch. Such dispatch often results in saving money, especially if the holes are wet, and it also means disposing of a rather unpleasant and anxious job quickly. From four to six tons of stone is generally considered good for primary shooting in well-drill work. If the bottom is heavy or if there is a hard toe, use a higher strength explosive at that point, loading the upper part of the hole with lower grade.

Do not load holes when too near a steam shovel or locomotive, unless a screen or awning is used to prevent sparks or hot cinders from falling into the hole. Some very disastrous accidents have resulted from this cause alone in the last year or two.

In well-drill work the holes are usually drilled and blasted in single rows. Some experienced men think that better results and greater fragmentation are obtained by blasting two rows at a time. Most quarries, however, use the single-row system. The single row is best when the face of the stone is 50 ft. high or over; below that height, it depends upon local conditions. The general practice with relatively shallow holes from 20 to 30 ft. deep is to blast from two to five rows at a time in order to break the stone up well and in greater volume so that the track and shovel movements are kept at a minimum. When more than one row is carried, the holes in the back row should be loaded at least 10 per cent heavier than those in the front for best results, and the spacing between rows less than the distance from the first row to the edge of the face.

Use of Buffer.

In high faces, the double row is not advisable at all. Often, even in quarries where the face is 50 ft. or under, only one row is blasted at a time, but a buffer of stone is carried; that is, a whole or part of a shovel cut from the previous blast left against the face to be shot. The buffer offers greater resistance or confinement to the charge and better fragmentation is gained. It is used in many cases, especially in lower faces, to hold back the material so that the stone is piled up high enough for economically working a steam shovel and avoiding irregular track and frequent moving. In higher faces, from 50 to 200 ft., no buffer is necessary as each blast is cleaned up before another is thrown down.

The tripod method of drilling is well suited to quarries where the stratification is irregular or pitching heavily, and where it is impossible to maintain regular benches.

The Snake-Hole Method.

In many of the harder limestone, trap and granite quarries, very economical results are obtained by the snake-hole method. In many of the Eastern quarries a 50- to 60-ft. face of rock is brought down with a single row of bottom holes which are heavily sprung. The holes are drilled horizontally at the bottom of the face from 20 to 30 ft. in depth and sprung heavily. It is best to start the hole about 3 ft. above the floor, allowing it to dip so that at the point it is just above or at the level of the floor. A certain dip must be maintained to allow water to flow to the drilling surface.

It requires considerable judgment to spring holes successfully. After some experience the blaster soon gets sufficiently familiar with the ground to tell quite accurately how often he must spring, and how heavily, in order to accommodate sufficient pocket charge to lift the burden. Some rocks respond to springing much better than others. Holes are usually spaced about 8 ft. apart. A strong, quick explosive is best suited for springing holes. The first charge should not exceed three 1 1-4x8-in. cartridges. If there is drill muck or water this charge will not do much more than clean out the hole and will have a slight heating effect on the hole walls. If the hole is drv. this charge will enlarge it somewhat at the back and heat the walls. In the first case it is unnecessary to wait longer than half an hour before loading the second charge; if the hole is dry, it is advisable to wait 1 hr. The second charge should consist of, say, six cartridges; after firing, 1½ hr. should elapse before loading the third springing charge. Each subsequent springing charge is increased so that the chamber or pocket made by the preceding one is filled, or perhaps it is best to let the explosive rise a few inches more each time until the necessary size of chamber is obtained. Compressed air may be blown into the hole after springing, which, besides blowing out a great deal of pulverized rock, hastens the cooling and makes the work safer and quicker.

Many accidents have been caused by loading the final charge of explosive in the bore holes too soon after springing, the charge taking fire from the heat of the hole. A rough idea of the temperature can be gained by allowing the tamping stick to stand in the hole about 5 min. and then feeling the end of the stick to find out whether it is warm. To be absolutely sure, the intervals between charges should be:

After the first spring wait 1 hr.; the second, 2; the third, 3; the fourth, 4; the fifth, 5. It is seldom necessary to spring more than five times. It is advisable to wait after the last springing is done until the following day before loading the holes. A strong, quick explosive like 50 or 60 per cent Straight N. G. is best for springing in hard rock. For loading the chamber an explosive of lower strength and slower action is best.

For a secondary drilling, rotating hammer drills are now generally used. It is good practice to drill the large stone rather than to resort to adobe blasting or mud capping. It requires about 20 per cent as much dynamite loaded in a block hole to break a stone as it would require to "doby" it. Moreover, an explosive of lower strength than is used for primary shooting can be used for block hole work. Whereas a strong, quick explosive is required for mud capping, a 20 or 30 per cent ammonia dynamite is advised for block holes in the dolomites or hard limestones, and nothing higher than 40 per cent for traps or granites.

Mud capping except in emergency is very wasteful. When it is practiced the cost of secondary blasting averages about four tons per pound of explosive, while in block-hole work the cost runs from 15 to 18 tons per pound of explosive.

Only the best blasting accessories should be used with explosives. Great care should be exercised in testing electric blasting caps and in making connections, the joints being made tight, clean and dry. Only series connections can be made when blasting machines are used as a source of current, because these machines are designed only for series firing, having only about 1½ amperage, and a voltage sufficient to fire their rated capacity.

It is best to fire big blasts with a power or lighting circuit, say, either direct or alternating current of 25 cycles or over. It requires 1½ amp. to fire any number of electric blasting caps in series, but this strength must be maintained all along the circuit. Therefore, the greater the number of caps in series, the higher the pressure necessary to hold the current up. There should be supplied 1½ amp. and a voltage equivalent to 1½ times the number of caps in the series. It is better, however, when power is used for firing, to connect electric detonators in parallel or parallel series. When straight parallel is used in well drill work with electric blasting caps, ½ amp. should be provided for each cap in the circuit, when a high amperage but a low voltage is required. In parallel series, at least 1½ and better 2, amp. should be provided for each series.

In priming deep well drill holes use sufficient detonators distributed along the charge both to assure thorough detonation and to afford a way out in case one should be broken during loading; at least two caps should be loaded in any bore hole. Missed holes are expensive and often fraught with danger and no effort should be spared to prevent their occurence. If the proper rules and instructions are carried out, there should be much less trouble from this source than unfortunately exists now in many quarries.

Cordeau-Bickford, or detonating fuse, is coming into general use for firing large blasts, is especially adapted for well drill hole blasts, and very safe, sure, efficient, and easy to manipulate. Cordeau consists of a lead tube about .22 in. in diameter, filled with T. N. T. It has a rate of detonation of about 18,000 ft. per sec. and is therefore of great value as a detonator in quickening slow explosives and assuring complete detonation of explosives of low sensitiveness.

Storage of Explosives.

The storage of explosives is often sorely neglected. They shouid be stored in dry, well-ventilated magazines, preferably of brick construction, the walls being thick enough to be bullet proof. Cases of high explosives should be stacked in proper position and the oldest dynamite should be used first. Blasting accessories, such as electric blasting caps and blasting caps, should be stored in a separate cool, dry building.

Quarry operators are giving more attention to the subject of explosives. Many of the larger companies employ a blasting superintendent who devotes all his time to studying blasting methods and keeps in touch with the various plants. Accurate cost data are kept and in many instances a great saving has been accomplished, proving that close attention to this important question is worth while.

Where it is not possible to employ a blasting superintendent, the operator sees that the blasting is under the supervision of an intelligent foreman. This man should render a daily report showing the quantity of explosives used, the purpose for which they were used and where, with remarks showing the results obtained. He should see that explosives are properly stored and

used; keep a record of stock on hand, using the oldest stock first, anticipate his needs to avoid running out and report them to the superintendent. As the blaster may either save or waste a considerable amount of money, an incentive should be given good men to take that position by making the remuneration commensurate with the danger and responsibility involved.

While undoubtedly there has been an awakening of interest in explosives among quarrymen, there is still much to be done in the way of reducing waste and increasing efficiency and economy in quarry blasting.

New Book Cements, Limes, and Plasters

John Wiley & Sons, Inc., New York, N. Y., have just issued the second edition, revised and partly rewritten, of the book by Edwin C. Eckel, C.E., entitled Cements, Limes and Plasters—their material manufacture and properties.

In preparing the second edition of Cements, Limes and Plasters, the original work has been extensively revised, statistics and reference lists have been brought up to date, and about one hundred pages of entirely new matter has been added. In order to permit this, and at the same time keep the book within reasonable limits in size and price, the space formerly allotted to natural cement has been correspondingly reduced, as that industry is falling off in importance. The book has 655 pages (8 vo.) sent on receipt of price, $6.50 net by Cement & Engineering News, 22 Quincy St., Chicago, Ill.

Workability in Concrete

Wetness Versus Fatness

Every brick mason knows that lime gives to mortar a quality that no amount of water or cement can give, "fatness." This quality is desired both because it makes the work easier and because it makes better work. It also gives strength to the structure because the brick are better bedded, and the passage of fire or air through the wall prevented for the same reason. Fat mortar is so important to the bricklayer, that more than one strike has occurred when other mortars were specified, and in fact, the desirable properties of lime are such that it is a rare case where *some* lime is not used, even though the specifications call for other materials.

Fatness is still more important in concrete, for sand stone and cement are naturally very short, harsh, rough and hard to handle. It must be dumped clean from the mixer, conveyed in buckets, buggies or barrows, and sometimes in chutes or trucks for long distances, without separating or "segregating." It must then flow into narrow forms, around steel bars in complicated mats, electric conduits, odd shaped frames and sharp corners, all without leaving stone pockets or bubbles, and must show a smooth surface when the forms are removed.

In all parts of the country, practical men tell us that hydrated lime added to the cement improves concrete at all these points, and its use for this purpose consequently has grown rapidly. But this quality of "Workability," so much desired and sought after, has never been defined or measured. Many attempts have been made to measure it, such as the slump tests, the flow table, and the angle of flow in chutes, but each has a fatal defect—namely, that any desired reading can be secured by adding water. However, segregation is increased, strength is reduced, and fatness is not gained by addition of water.

The recent tests by Professor Abrams of Lewis Institute, which are being widely advertised by the Portland Cement Association, are the most pretentious series ever run, on the effect of hydrated lime in concrete. They purport to eliminate all the variables except *strength,* and measure that. The tests may be divided in two groups; hydrated lime added *dry,* and hydrated lime added *with water.* In the case of dry additions, the strength is greatly increased but the results are dismissed by Professor Abrams with the statement that the consistency was changed, the batch being too dry to work.

That strength *can* be increased in this way, is evidenced by the following statement of Colonel H. C. Boyden, expert lecturer, for the Portland Cement Association. "The use of more cement (than the ideal amount) in a batch, does not produce any beneficial effect, except from the fact that a *plastic, workable mix* can be produced with a lower water-ratio. The reason that a rich mixture gives a higher strength than a leaner one is not that more cement is used, but because the concrete can be mixed with a water-ratio which is relatively lower for the richer mixture than for the lean one. If advantage is not taken of this possibility of reducing the water-ratio the additional cement in the richer mixture is wasted."

When both water and hydrated lime were added, the *workability* was much *improved,* but this fact is not made plain. The water allowance was proportioned by the Vicat needle test for normal consistency. This, however, reveals nothing as to workability. Neat lime specimens reading the same by the needle, may vary extremely in workability themselves, and have widely different effects in this respect on the concrete to which they are added. In short, consistency, with the Vicat needle measures, is entirely different from "fatness."

Further on, the author reports figures which he maintains are an index of "plasticity" in concrete. In the Abrams tests, concrete of unit consistency is defined as that which slumps ½ in. to 1 in. in a cylinder 6 in. in diameter and 12 inches high, but the very first group of five specimens slumped an average of 6.2 inches and the whole result of the slump tests when platted graphically, looks like a crazy quilt, having no rational trend whatsoever. The American Society for Testing Materials has abandoned this form of cylinder and adopted one with a ½ in. taper, and while this will eliminate some of the minor objectioons to the test, the most important one remains; namely, it does not measure the right property, the one in which concrete men are interested.

The Portland Cement Association attempts to support these contentions with the tests of Professor H. H. Scofield of Cornell University. He states in his report, however, "The degree of wetness in mixing was medium and judged by the eye in each case, being constant for all mixes. *No attention was paid to "workability"* or "water-ratio" at the time of mixing the mortars.

"Workability" is the best word yet devised for the desired property, for "plasticity" and "flowability" cover only part of the meaning while "consistency" refers only to "apparent wetness;" but "workability" like "strength," has a wide application. "Strength" may mean compression, tension, torsion, shear, bending, or other combinations. In the same way "workability" includes easy dumping from the mixer, bucket, hopper or buggy, proper flow down a chute, around reinforcing and other obstructions into complicated forms and sharp corners, freedom from segregation, and from stone or water

---

This paper is prepared by the National Lime Association, Washington, D. C.

pockets, easy tamping and easy finishing under the machine or trowel. Up to the present time this quality has been one of those which are said to be incapable of expression in English, but "One must *feel* it with his tool."

This attitude, however, is destructive of progress, and we can never advance unless we make the attempt to define and measure these variables, however elusive they may be. Here is a problem worthy of the mettle of the finest minds in concrete engineering, and should attract the eager hunter of new truth. I mean that what is wanted is not support for some pet theory, or advertising for some material, but the whole truth, irrespective of its effect on any material; for only the truth can benefit the public at large, and in the end it is certain that the scientific facts will govern the practice to which manufacturers must conform.

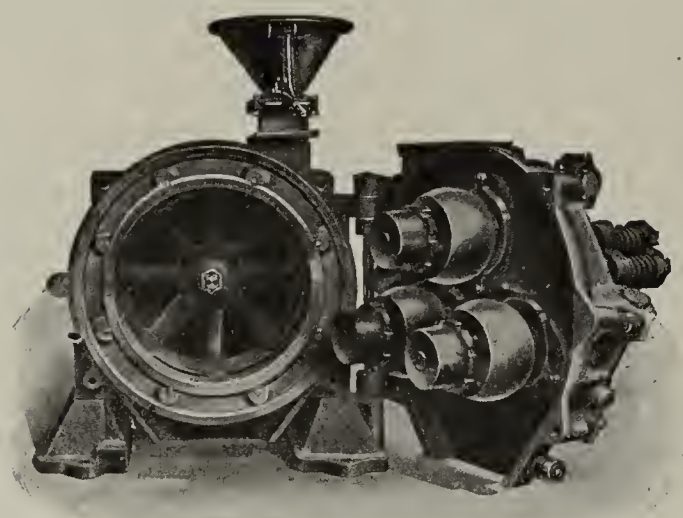
Let us then continue the effort to define and measure "fatness" in concrete, knowing that what is common knowledge among the trade must, sometime, yield to scientific investigation; and that the knowledge then secured will be of inestimable value to industry.

Agricultural Limestone Machinery

By L. H. Sturtevant, Vice-Pres. and Gen. Mgr. Sturtevant Mill Co., Harrison Sq., Boston, Mass.

The benefits to the soil by the use of agricultural limestone are now universally recognized and thousands of tons are distributed regularly to the farmers in many sections of the country.

The kind of soil needing lime, the amount to be applied per acre, the fineness of the lime and the kind of machinery producing it has also become standard-



Ring Roll Pulverizer.

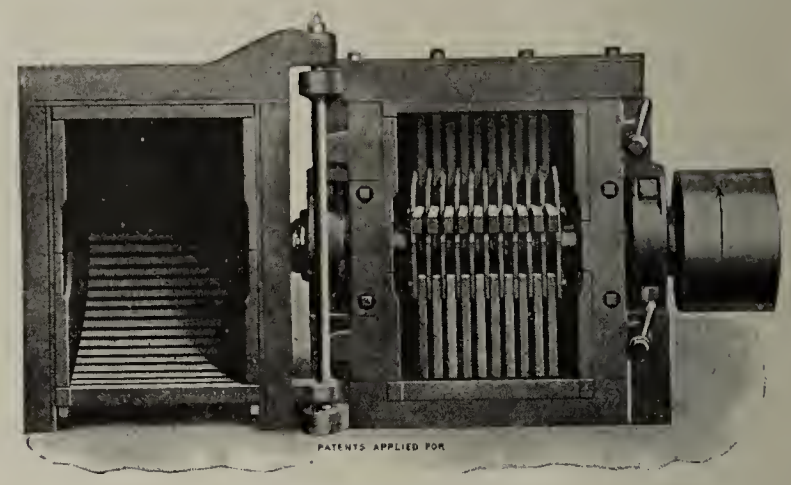
ized so that now nothing remains to hinder this rapidly growing industry.

It is now strictly up to the machinery manufacturers to perfect their mechanisms so that ground limestone may be produced at minimum expense.

Simplicity, durability, quick accessibility, reasonable cost and minimum power are the principal points to be considered.

As this business is divided into three classes of producers, each requirement must be carefully considered so that the right machine will be purchased in each individual case. These classes are divided as follows: First, the large producer of agricultural lime, grinding hundreds of tons per day; second, the small producer who operates on a moderate scale of about 100 tons per day; third, the small grinder who wishes to produce limited quantities of limestone as a by-product or to run his machine intermittently as limestone is required.

The first class can afford to invest the necessary capital for a complete plant designed for quantity production, install dryers and the best of labor-saving equipment to produce at least cost. The second class in some cases can do likewise, but many times would prefer to limit the investment even if the ground stone costs more. The third class in practically all cases must install a plant at the lowest possible price, con-



Swing-Sledge Mill.

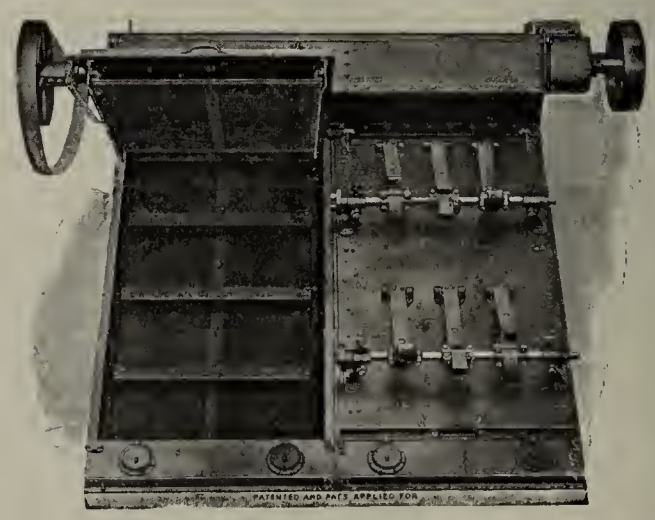
sistent with good machinery and manufacture as cheaply as it is possible under the circumstances.

There are two types of pulverizers well suited to this business—the ring-roll mill, which is in a class by itself for large outputs at low cost; a great big, slow speed, durable grinder, which one can install and forget, as far as wear, tear or trouble is concerned, and then there is the high-speed, swing-sledge or hammer type of pulverizer more widely used on account of its lower first cost and simplicity of plant.

Of the two types of machines the one recommended entirely depends on conditions, each being first-class in every respect. The low-speed mill is the more durable, and also is more expensive and requires a screen, while the high-speed machine takes more power per ton of rock ground, and the upkeep expense is greater; it, however, needs no screen.

For the small producer the swing-sledge mill is without question the better of the two; for the large manufacturer of the ring-roll is superior, but the man of medium requirements should look carefully into both types before reaching a decision.

Both machines are simple and easily operated. Both



Newaygo Super-Screen

have the accessible open-door construction, through which replacements can quickly and easily be made, each has adjustments.

They differ greatly in principle, the ring-roll crushes the limestone on itself between ring and rolls, where it is held by centrifugal force. Ring and rolls do not touch each other, the crushing and grinding action is

entirely by pressure exerted at slow speed against the limestone itself, which accounts for its extreme durability. The swing-sledge mill pulverizes by a series of tremendous blows delivered at lightning speed to the stone fed into it. Nothing can withstand such impacts, and the fine stone passes through grates at the bottom of the mill case. One can see at a glance that such a machine must necessarily wear considerably, but being armored, this wear is not excessive per ton of stone ground.

A proper decision therefore depends on many circumstances—capital, competition, output, operating expense, etc.

Moore Unit System of House Construction

Concrete units made under the Moore Structural System offer an excellent opportunity for large-scale production of houses, such as industrial developments require. The units are of such a nature that they may be conveniently manufactured at a central plant, in stock sizes, and shipped to the building site by rail or truck. Repetition of design is not necessary, since the units are small enough to permit of considerable variation. Plans need only take into account the dimensions of the stock sizes to be used. The Moore units consist of standard channel-shaped wall sections about 12 inches wide and 8 inches deep, with a length equal to the height of one story. The webs and flanges

Concrete Residence of W. B. Scott, President, Southern Pacific R. R. Co., Galveston, Texas, Is Built after the Moore Structural System.

are 1½ inches thick. A section weighs approximately 375 pounds. Sections are set up vertically, with the open side of the channel turned in and the back, or outside, deeply scored to form a ground for stucco. Proper alignment is obtained by means of a frame. The lower end of the section is set into a groove forded in the foundation, the remaining space in the groove being filled with concrete in order to hold the wall sections firmly in place. If the wall sections are cast with holes in the flanges about 4 inches from the base, through which steel rods may be passed, additional security is obtained. At the top the sections are formed into a U-shaped trough, which, after one story is set in place, is filled with steel reinforcement and concrete, including dowels projecting 6 or 8 inches above the lintel so as to engage the units of the next story. This forms a continuous lintel beam around the entire structure and positively zinds the sections together. The sections themselves are reinforced with four ¼-inch round rods, tied with stirrups of No. 9 wire. The foundation wall likewise contains steel reinforcement, placed longitudinally, so that the combination of foundation wall, vertical wall sections and lintel beam act together as one unit.

If a second story is to be added, the operation is repeated for that story, the wall sections being set on the lintel beam and additional concrete added to form a tie with the dowels previously placed. Bolts are set into the concrete lintel beam of the upper story and a wall plate is bolted down to receive rafters and ceiling joists if these are of wood.

Concrete Pipe Molds

The Universal Concrete Products Company, New Martinsville, W. Va., who have recently placed upon the market molds for making concrete pipe, write as follows: "We are concrete pipe manufacturers. The hard school of experience has taught us many things about concrete pipe molds. While other pipe manufacturers have preferred to retain the special developments in pipe mold making to themselves, we have decided to let the beginner profit by our experience. This we believe to be the best policy for the industry in the long run. 'Universal' molds are not cheap molds. They embody principles which do not allow cheapness but which give you molds which do not have to be marked off the books at the end of the year as 'junked.' Our standard molds are made for the specifications now generally used by all the Highway Departments of the various states. However, we can modify them to suit your own peculiar conditions."

Review of Catalogs

BOSS MIXERS. An 8½ x 11, 16-page catalog describing with illustrations in a very comprehensive manner the various types of Boss Concrete Machinery, including Heavy Duty Mixers, High Drum and Draining Mixers, Building Mixers, Half Bag Mixers, Bridge Builders' Mixer, Pavers' Attachments, Hoisting Attachments, and other types manufactured by the American Cement Machinery Company, Keokuk, Iowa.

Williamsport Wire Rope Co., Williamsport, Pa., has published a large 4-page illustrated folder in which wire rope is described. A feature of this rope is the patented tape markers which appear in the center of the core, indicating clearly the various grades or rope. These markers do away with the necessity of an expensive laboratory test in order to determine the various grades of rope.

Efficient Sand and Gravel Dredging

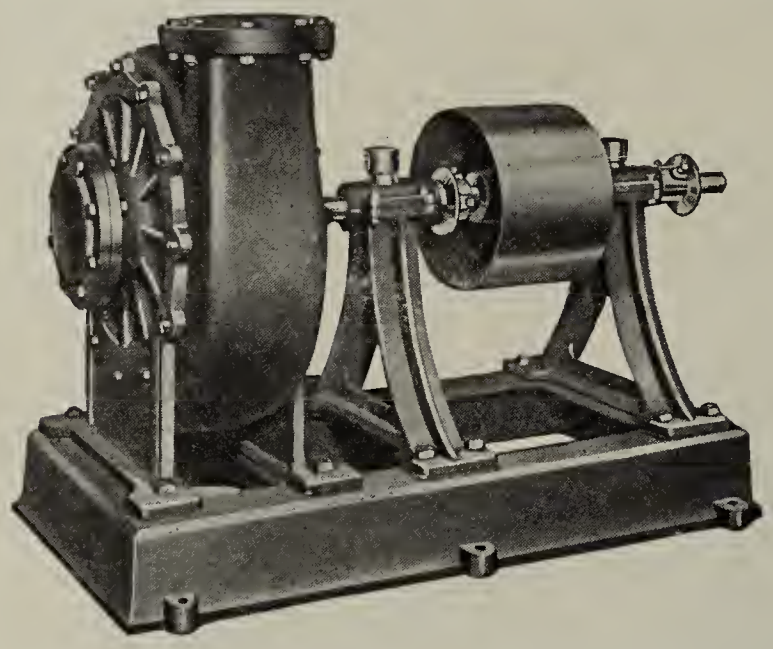
Producers of sand and gravel, using centrifugal pumps are vitally interested in producing sand and gravel at the lowest possible cost. The price of sand and gravel is influenced by labor cost, fuel cost and repair cost.

Lightning centrifugal sand and gravel pumps manufactured by the Kansas City Hay Press & Tractor Co., Kansas City, Mo., have proven beyond a doubt that they produce sand and gravel at the lowest upkeep cost per ton.

The life of Lightning semi-steel pumps is many times greater than shells and runners made of other metals, and due to the long life of those parts, which come in direct contact with sand and gravel, frequent shutdowns and replacements are eliminated: consequently the cost of repair parts per ton of material produced, is greatly reduced.

Lightning pumps are so designed that they operate under high efficiency, which means that they will produce more solids per hour with less horse power.

As to details of construction, the runner is so designed that it will take all large sizes of rocks that can pass through the suction discharge pipe, thus eliminating choking of the runner. The runner is machined,



so that it makes a close fitting runner inside of the shell.

The shaft is of large diameter, and is mounted in a specially long main bearing, thus eliminating distortion or breaking of the shaft, or vibration when the pump is operating under a heavy load.

The thrust of the pump is taken care of by the ball bearing thrust bearing, mounted on the shaft. This eliminates friction to a minimum, and any thrust troubles, which is a feature that every pump user appreciates.

The pump is so designed that it can be readily dismantled. The general design is as near perfect as can possibly be made, for this pump was designed on recommendations and suggestions made by users of sand and gravel pumps, having many years' experience, and all troubles that they had experienced have been taken into consideration and eliminated.

Standard "Lightning" pumps are built in 4-inch, 6-inch, 8-inch, 10-inch and 12-inch sizes and larger sizes are designed and built to suit conditions. They are furnished either belt drive or direct connected for either engine or motor drive.

Here is what one user of Lightning centrifugal pnmp has to say regarding this machine:

"With reference to revolutions per minute would say that we run 700 to 750, we are pumping again a 36-foot head, our suction line is now 196 feet long, our discharge line is 137 feet long, the base of our Pump is only 2 feet above the water line of the lake from which we are pumping, we consider it important to get the Pump as low and close down to the water line as possible, we actually pump two thousand gallons of water and one ton of sand per minute, even with this long suction line, with a shorter line we could pump much more.

Our pressure shown by our Guage on the discharge is 27 to 30 pounds, our Vacuum varies from eighteen to twenty-five pounds, on these lines.

It is important, to keep your bearings lubricated and cool and free from grit. We force a half inch stream of water through the hole you provide for suction intake, we do this with a small jet, this makes bearings and packings last far better. The Semi?Steel Runners and shells are almost equal to manganese steel.

This new pump has surprised all of us and we have had about fifteen years in actual experience in pumping Sand and Gravel. There are so many superior features about this pump that are not found in other pumps; viz., Such large capacity, for so light and neat a design, its wonderful wearing qualities, its simplicity just to think it is only a few minutes work to unbolt and take it down and change any worn part and throw it right together again and have a pump like new.

This item of repairing is a wonderfully interesting matter as it is so burdensome, as well as expensive in all other pumps we have had in past, but here the parts are inexpensive, so muc hso that we keep them on hand ready, and the writer candidly believes that there is no part about this new pump that we could not take out, replace, and be running in three hours. Any pump user knows what that means.

The facts are that we are so much pleased with this pump that we hardly know how to fully express it. We believe that this pump should have a prominent place in the production of sand and gravel, true, many users buy pumps without experience, and while this is the most simple and most easily operated of any we ever saw, at that many inexperienced in the use of such pumps, have trouble with the best of them until they learn, but anyone that has one of your pumps if he should have any trouble, tell him to write us and tell us his troubles and we will not charge him a cent to fully explain how we do it.

Thanking you for the splendid service, good pump, and wishing you the compliments of the season, we are

Very truly yours, W. S. Keller, pres. Empire Sand & Material Co., Marshalltown, Ia."

Underfed Stokers

Westinghouse multiple-retort underfeed stokers, manufactured by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., have been constructed and put in successful operation in combination with the largest boilers ever equipped with a single stoking unit. To facilitate the removal of ashes, double roll water-cooled clinker grinders have been provided at the innermost end of the stoker, or at what is usually the bridge wall of the furnace. In another large stoker installation, each boiler is equipped with a double stoker, firing being done from both ends of the boiler, extremely high combustion rates having been secured, providing good economy at high overload capacities.

Aggregates for Denver- Morrison Highway Supplied by Hydraulic Plant

To supply sand and pebbles for the concrete pavement on Federal Aid Project No. 82, between Denver and Morrison, Colorado, an aggregate plant has been built in which the materials are lifted from a dry creek bed with a "Lightning" pump, manufactured by Kansas City Hay Press & Tractor Co., Kansas City, Mo., and forced through a pipe line to the screens. The plant is located on the banks of Bear Creek, approximately 1 mile south of Midway, Colorado, and immediately adjoining the main road connecting the Denver-Morrison and the Fort Logan-Morrison Highways.

Gravel from a dry bed in Bear Creek is "slipped" with teams to a 2 by 3 foot grizzly with 2½-inch openings. The grizzly is set in the floor of a wooden platform slightly raised above the general ground level. Materials smaller than 2½ inches drop through the grizzly into a sump. To facilitate the passing of the aggregate through the grizzly a stream of water from a 2-inch hose is flushed over them. The water supply for this purpose is obtained from the overflow from the sand box on the screening plant. Oversize material rejected by the grizzly is thrown to one side with a shovel.

The material is lifted from the dump through 18 feet of 6-inch pipe lying at an angle of approximately 30 degrees to an elevation of 8 feet by means of the "Lightning" centrifugal pump, manufactured by Kansas City Hay Press & Tractor Co., Kansas City, Mo., especially designed for this purpose. The pump is belted to a 65 h. p. tractor. The sump at the end of the intake pipe is a wooden box below ground water level, with a 2½-inch grating over its top. From the pump the materials pass through 300 feet of 6-inch pipe to the top of the screens over the aggregate bins. The discharge is about 33 feet higher than the intake.

There are only 2 elbows in the pipe line, one connecting the intake line to the pump and the other connecting the pump to the discharge line. Short pieces of steel lined hose were first used for elbows, but these had to be replaced every 2 or 3 days because of wear. The steel elbows subsequently installed rendered efficient service and no replacement was necessary during a period of approximately 3 months.

At the point of discharge the aggregates drop on a sloping screen of ¼-inch mesh, through which the water and the sand pass into a 6 by 6 by 4-foot sand settling box with sloping bottom. A 4-inch overflow pipe at the top of this box carries away the dirty water and all impurities. When the box is full a gate near the bottom is opened and the sand discharges into a 14 by 14 by 10-foot bin directly underneath.

The coarse aggregate passes over the ¼-inch mesh screen onto a 2-inch screen, through which it drops into a 14 by 7½ by 10-foot bin. The oversize rejected by the 2-inch screen rolls over the end of the bin to a waste pile on the ground. Trucks are loaded through sliding gates and chutes located in the sides near the bottom of the bins.

The amount of material pumped into the bins varies with the amount that can be moved from the gravel bed into the sump. The average output of from 60 to 80 cubic yards per 8 hour day does not represent the capacity of the pump but is determined by the amount of material that can be brought to the sump, and the speed with which the aggregates were hauled from the bins to the job. The output secured was sufficient to meet the needs of the job and the size of the contract did not warrant the installation of more elaborate equipment. Operating continuously, it is estimated that a maximum of 125 cubic yards of aggregate could be turned out in an 8 hour day by this equipment.

The necessity for washing the available material prompted the contractors, The Colorado Bridge and Construction Co., of Denver, to erect the plant with equipment which was already at hand. An excellent quality of clean, well graded aggregates was secured, contributing materially to the construction of a first class concrete pavement.

Pumping end of the aggregate plant on the Denver-Morrison road project at which aggregates were pumped from the dry bed of Bear Creek.

Plans of Concrete Houses

A new book showing designs of 25 concrete houses has just been issued by the Portland Cement Association, 111 W. Washington St., Chicago, Ill. These designs are the work of leading architects of the country, and represent the excellent results that can be secured by using concrete as the construction material.

The price of this is 50 cents. Complete blueprint plans, specifications, and quantity surveys of each house can be obtained at $10.00 per set.

The Kent Junior Batch Mixer

The Kent Junior Batch Mixer manufactured by the Kent Machine Company, Kent, Ohio, has a very substantial truck and frame, designed to stand not only the use which a concrete mixer receives, but also the abuse which is oftentimes heaped upon a machine of this character by those engaged in contracting work. The axles are large and securely attached to the frame, the wheels having 3-inch wide tires, with gauge to suit that of the standard wagon. The frame itself is made of heavy steel channels, thoroughly braced crosswise and diagonally by heavy angles and bars and is rigidly fastened at the corners. The machine is 8½ feet long and 5½ feet wide over all.

The price of this mixer will interest you—due to the special facilities and unusual manufacturing advantages of the Kent Machine Company.

The drum is made of heavy steel plates with iron heads and the mixing blades or scoops on the inside of the drum are fastened to the drum in such a way that replacement of broken and worn parts may be easily made with only the ordinary wrench as a tool.

The drum itself is carried on four solid trunion wheels, the surfaces of which have been chilled and which revolve in bearings of substantial design which are fitted with bronze bushings. This enables replacements of worn parts to be made by the purchase of simply a small bushing.

The sprockets and chain used in transmitting the power from the engine to the intermediate shaft and from the intermediate shaft to the drum are heavy in design and are made for long wear. The chain gives a flexible connection between the engine and the drums so that neither vibration, misalignment or wear can affect it.

New Book Concrete Products

CONCRETE PRODUCTS, Their Manufacture and Use, by Harris and Campbell, is planned to assist those about to engage in the manufacture of concrete products. It helps them to determine (1) The products which can be sold in the shipping radius of the proposed plant; (2) The machinery, tools, general equipment, and processes to be employed in manufacturing the products; and (3) The methods to be employed in promoting and selling concrete products.

The authors are Wallace R. Harris, formerly managing editor of *Concrete Products,* now managing editor of *The Highway Engineer and Contractor;* and H. Colin Campbell, director of publications for the Portland Cement Association.

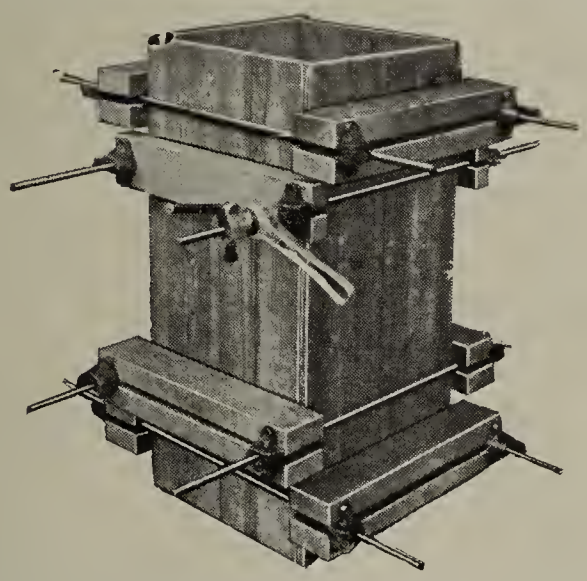
The information presented is practical and clearly written. There are chapters on *Concrete Products as a Business, Selling Concrete Products, Specifications For Building Units, Materials Used in the Manufacture of Products,* and also chapters devoted to the commercial products made of concrete.

To anyone interested in the manufacture of concrete products this is a most useful handbook of information. Sent on receipt of price $2.50 by CEMENT AND ENGINEERING NEWS, 22 Quincy St., Chicago.

A New Form Clamp

For many years engineers and inventors have been trying to solve, for the contractor, the problem or saving on concrete forms. They have had fair success. Even with all their inventions they have not until recently been able to perfect a clamp that is entirely satisfactory, but they kept on working, trying to give the contractor a clamp that could be put on in less time, and be entirely free from the possibility of slipping.

The engineers of The Victor L. Phillips Co., 7th and Delaware Streets, Kansas City, Missouri,



have recently announced a perfected form clamp, which has been used with great success. It is simple to put on. The only tool required is a ratchet tightener. Any laborer can put on these clamps as easily as a mechanic. And they cannot come loose, as the harder the stress the tighter they grip. They can be used on both walls and columns, any thickness or any size. They are put on in half the time and the ratchet tightener enables you to work up against another wall or in very close quarters with great speed.

The Right Refractory in the Right Place

It is not enough to look only for quality in the fire brick and other fire clay refractories you buy. A good fire brick will not last long in the wrong furnace.

A refractory manufacturer's real value to you lies in his ability to recommend the one brand best suited to your particular practice. To do this he must have more than a thorough knowledge of his own business; he must have just as thorough a knowledge of yours.

Crescent Refractories Co., Curwensville, Pa., not only make good refractories, but they know the actual working conditions to which those refractories will be subjected in the cement and lime industries. This knowledge is based upon endless study and investigation—upon the extensive activities of a well-equipped research laboratory—upon reliable data that have been proven to be scientifically correct.

So whenever a representative of Crescent Refractories Co., calls upon you, bid him welcome. Regardless of whether you buy anything or not, his knowledge and experience are yours to profit by. And when he does sell you Crescent refractories, you will soon realize that their uniformly-high quality and perfect suitability to the work in which they are used, makes them the most economical refractories you have ever used.

A New Direct-Drive Secondary Crusher

Crushed stone people and gravel operators having over-size gravel to crush will note with interest the announcement of the Weston direct-drive gyratory crusher for rejection or secondary work, which is be-

ing manufactured by the Morgan Engineering Company.

The crusher is designed as a rejection machine for following primary crushers and reducing over-size hard rock or ore. All parts of the machine subject to wear are inexpensive and replaceable with a minimum of work and time. The motor is mounted in a vertical position and connected direct to eccentric by flexible coupling. In cases where electric current is not available, belt or rope drive may be used from line shaft or other sources of power.

Book Reviews

Longmans, Green & Co., publishers, 55 Fifth Ave., New York, N. Y., have just published a new book entitled "Elementary Hydraulics" for technical students by F. C. Lea, D. Sc. (Engineering, London). It has 224 pages, is 7½ by 5 inches and the price of the book is $2.40. This book has been arranged principally for students in evening and day technical schools who are desirous of obtaining some knowledge of the principles of Hydraulics. The importance of experimental work in these schools is now clearly recognized, and the subject of Hydraulics is one which, from the experimental, theoretical and practical sides, is worthy of an important place in the curriculum of such schools. A good deal of experimental plant can be installed of a comparatively inexpensive character, which is of the greatest value in the training of students.

News of the Cement Mills

O. E. Wasson, 14 Fairview Ave., Hudson, N. Y. advises us that the report that he has accepted a position with the Crescent Portland Cement Co. at Wampum, Pennsylvania is untrue.

G. L. Austin, has resigned his position with American Refactories Co., Joliet, Ill. and expects to sail Sept. 15th, for Kymore, India where he has accepted a position as works manager for the Central Province Portland Cement Co. Ltd.

W. T. Groner, formerly superintendent of the Petoskey Portland Cement Co., resigned that position to accept a similar position with the Sandusky Cement Co., in building and operating that company's new plant near Toledo, O.

Bailey Trember, formerly chemist for the Superior Portland Cement Co., Concrete, Wash., is now engineer of tests for the Division of Highways of Washington. C. L. Wagner is handling the duties of chief chemist as well as superintendent of the Superior plant.

H. J. Robertson, former chief chemist of the Western States Portland Cement Co., is now with the Pierce Oil Corp., as chief chemist at Sand Springs, Okla.

The fourth dividend of 3½ per cent on the preferred stock of the Oregon Portland Cement company was paid last week. This payment makes the distribution of dividends 14 per cent since last fall, but as the 7 per cent dividends yearly are cumulative since 1915 the preferred shares have still 35 per cent to be paid on them before the common stock would be entitled to its first dividend, even if surplus earnings were now available for this purpose. The cement plant at Oswego is operating successfully and prospects for continued dividends after long years of waiting are said to be encouraging.

Preferred stock of the Oregon Portland Cement company is quoted at 75 bid and 90 asked, while the market for common stock is 40 bid and 50 asked.

Mr. John A. Blank, Supt. Georgia Cement & Stone Co., Portland, Ga. writes us as follows: "We noticed in your last issue an article which stated that the Georgia Cement and Stone Company at Portland, Ga., recently acquired by the Nicholson interest, would *not be put into operation for cement* production. In order to correct this statement, we desire to state that we are re-modeling this plant at present and expect to produce cement in a few weeks.

"John A. Blank is in charge as General Supt., having been connected with the Nicholson Corporation for many years; and together with several Engineers is rushing the work with all possible speed. This Plant when completed will be one of the most modern in the country. Large Storage tanks are built for storing Crushed rock, fine Raw material and Clinker, which will enable this Plant to produce a uniform product of the best quality. The Crushing Plant is operating to full capacity for Commercial rock."

A novel contest is being staged at the Glens Falls Portland Cement Company's plant at Glens Falls, N. Y., under the direction of Frank Sansouci, safety director, the object of which is to eliminate accidents. The contestants are the employes of the ten departments of the plant, divided into ten groups, each with a chairman, who is a member of the safety council.

The contest is entitled the "safety horse race" by the employes of the company. Each department has its own horse, which is represented by a figure on a chart consisting of a number of squares. Each square represents a day. For each day in which no accident occurs in a department, the horse representing that department is advanced one day, or a square on the board. The horses have names. For instance "Wildfire" is the worthy steed which is making the race for one group of employes. Reminiscences of the days when Glens Falls was on the racing map are furnished by the horse "Delmar."

For minor accidents, which are a little too serious for first aid treatment only, on half day is marked off and for accidents requiring only first aid treatment, the department loses one-fourth of a day in the race. If any employe receives a minor injury and fails to apply for first aid, the department is penalized.

The cement works is not a particularly hazardous place to work, but in a plant employing hundreds of men accidents will occur. Persons who have made a study of the subject claim that the human element is a strong factor in ninety per cent of the accidents and it was for the purpose of overcoming this human element problem by making a concerted drive to eliminate accidents that the company established the safety department.

Southwestern Portland Cement Co., Victorville, Cal., is doing preliminary work for the proposed enlargement of its plant, the improvement to consist of one new kiln, an enlarged mill building, power house, new row mill, driving motors and other accessories. The kiln will be installed parallel to the two now in operation and will be 200 ft. long with a diameter of 9 ft. The construction of this part of the plant will be somewhat different from that of the present kilns in that the dust chamber will be considerably shorteneed instead of running the full length of the kilns. The flue gases will discharge directly into a stack which will be built in connection with the dust chamber. It will be necessary to enlarge the burning room to accommodate the new kiln, as the plan was originally designed for only a 2-kiln plant. A number of changes are planned for the crusher building in order to increase the output of raw material which will consist of new crushing machinery, mills, etc. At the quarry work is going ahead rapidly on the new ground recently opened on the east side of the hill, which, in connection with the old workings, will furnish an abundance of material to keep the enlarged plant in full operation. An electric line has recently been completed from the plant to the quarry, following the lane of the Mojave Northern railroad which provides juice for operating air compressors and other quarrying machinery as well as flood lights for night work. It is probable that new locomotives and cars will be purchased to haul rock from the quarry. The new equipment will greatly increase the efficiency of the plant.

Quarries *are* getting 1/3 more per dollar

"I am more than pleased to advise you that our trial blast of Dumorite, fired in our quarry at gave us very gratifying results.

"I, purposely, placed this powder in a very hard blast of holes 32 ft. deep, about 20 ft. back from the quarry face, which had a very heavy toe at the bottom.

"We found when the Steam Shovel reached this point, it had little difficulty penetrating through the blast. The bottom came out in fine shape.

"I like this new powder (Dumorite) so well that I have placed an order for some more to be delivered in our next carload."

Excerpt from letter of a user of Dumorite for large quarry operations.

LIKE most new products, Dumorite had to prove its value before it was accepted by the trade.

But often the results of a single shot with this new explosive changed the worst skeptic to the staunchest backer.

Dumorite, stick for stick, has approximately the same strength as 40% dynamite; case for case, these two explosives cost the same. But in every case of Dumorite there are from 35 to 45 more sticks than in a case of 40% dynamite—⅓ more for your dollar.

Write our nearest branch office for further information.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

Branch Offices:
Birmingham . Ala.
Boston . . Mass.
Buffalo . . N. Y.
Chicago . . . Ill.
Denver . . Colo.
Duluth . . Minn.
Huntington, W. Va.
Kansas City . Mo.
New York . N. Y.
Pittsburgh . . Pa.
Portland . . Ore.
St. Louis . . Mo.
Springfield . . Ill.
San Francisco, Calif.
Scranton . . Pa.
Seattle . . Wash.
Spokane . . Wash.

Du Pont Products Exhibit
Atlantic City, N. J.

NON-HEADACHE DU PONT NON-FREEZING

DUMORITE

THE LATEST OF A COMPLETE LINE OF DU PONT EXPLOSIVES

News of the Concrete Products Factories

Last year I had a splendid business and could have sold twice as many blocks could I have produced and cured same with unlimited facilities. I am more than pleased with results. There seems to be a splendid prospect ahead for me, this year, which I am preparing to take care of. Last year most blocks went to new pobs; this year no doubt it will be more to basements and foundations.

The greatest work I see ahead, whether for committee or otherwise, is the education of the coal shed producer of "cement blocks."

Freight rates are the greatest hindrance at the present time on sand and chatts. After 21 years of constant talking, "concrete" quality block to dealers, builders, masons and consumers, I am about to establish the fact that concrete blocks are "concrete" and adaptable to most all uses. Three years ago I had one basement constructed of my product. Next year about four or five, and last year 30 all told.

We have four large lumber yards and they are boosters for my product; they all formerly made "cement blocks" but are all now handling my product.

I have installed automatic equipment and from now on I will talk quality, write quality, insist on quality.

My product may not be the best, but it is away above the average.

Signed:
Lacy Peyton, Pres.,
Peyton Concrete Works,
Benton, Ill.

Ideal Concrete Machinery Co., 1338 Monmouth street, Cincinnati, are manufacturing a complete Automatic Block Producing Machine, which can be built up from an Ideal hand machine. This equipment consists of the Ideal Block Machine, Ideal Power Tamper, Ideal Core Actuator, Ideal Scraper and Finisher, Ideal Conveyor and Feeder and the new Ideal Automatic Cam Attachment. You will recognize that everything with the exception of the new attachment is their well-tried Ideal Power Equipment.

However, by means of the old Ideal Equipment it required 23 manual and pedal operations for the production of a block. By means of the new cam attachment, there 23 motions are reduced to one single motion; simply pulling out the starting lever. The machine then automatically feeds in the material and produces a block in 12 seconds, and then stops. Then as the block is removed and another pallet is placed in the machine, the lever is again pulled, producing another block in the same time.

This method of producing an automatic machine has two distinct advantages: In the first place, that of using the well-tried principles of Ideal machinery, which has been successfully manufactured for the last 12 years. In the second place, it is possible for any Ideal customer to obtain a completely automatic block machine without sacrificing any previoous equipment that he has purchased. If a man has an Ideal hand block machine only, he can build up from there on. If he has a hand block machine and tamper, he has that much less equipment to purchase for a complete automatic attachment.

Furthermore, the Ideal equipment has always been known for the production of a thoroughly square, true block, and particularly well adapted to face glocks and corner blocks. These advantages of the machine all maintain in the automatic outfit.

The Maul Co., Hancock, East and Dequindre sts., Detroit, Mich., manufactures art stone and cement products, operating Ideal molds and mixers. Wants prices and catalogs on mica spar crystals, white sand, marble chips, white cement and waterproofiing compound.

With the view of standardizing the quality of concrete products made and used in Southern California, a meeting was called recently of the concrete products manufacturers from all parts of the State.

At this meeting, held in the headquarters of the Portland Cement Association, Merchants National Bank Building, Los Angeles, Calif., a new organization was formed under the name of the Concrete Products Association of Southern California, which will automatically become a local branch of the national body, with headquarters in Chicago.

The meeting was attended by practically all of the manufacturers of concrete products who were highly enthusiastic over the idea of establishing a standard specified quality for all concrete products manufactured in Southern California. The new association will cover the territory in the State up to and including Kern county.

The following officers were elected: President, M. G. Watkins, president of the Los Angeles Concrete Tile Company of Los Angeles, Alhambra and Monterey Park, manufacturers of Lac-Tile Concrete Products; vice-president, R. E. Johnston, general manager of the Concrete Building Tile Company of Glendale, manufacturers of concrete hollow building tile and concrete brick. R. H. Hubbard, concrete products representative of the Los Angeles branch of the Portland Cement Association, was elected secretary and treasurer of the association. Four alternate vice-presidents were elected to serve as chairman of a committee representing the various branches of concrete products manufacture as follows: E. J. Pennypacker, Concrete Lumber Company of Los Angeles, W. L. Jencks, Jencks Brick Company of Los Angeles, F. C. Stenzel, Stenzel & Kerbs Stone Company of Los Angeles, and F. X. Enderb, manufacturer of concrete flue vents and burial vaults.

"The purpose of this association," said Mr. Watkins, president, "is to establish a definite and standard quality in the manufacture of all concrete products, which includes building units, architectural stone, art concrete, concrete hollow tile, concrete blocks and concrete bricks, and to give the consumer a finished product that will continue to live up to the slogan of 'Concrete for Permanence.' We have accepted as a standard the American Concrete Institute specifications which are now the basis of building codes in most American cities. In addition the association intends to give immediate attention to building code and adjustment and all other things of direct interest to the local manufacturers and those who use concrete products."

Running Straight and Saving Money

IT IS a well established fact that a conveyor belt that runs perfectly straight will last longer than one that sidles from side to side.

Idler edges will cut through or tear the back of a "crooked" belt and expose the duck to deterioration from moisture.

Here is a Goodrich "LONGLIFE" Conveyor Belt hauling clinker to a bin—*mark how straight it runs.*

No creeping over idler edges. No ripped, torn or worn edges or back. No spillage.

All "LONGLIFE" Belts run straight — they're made that way. A "LONGLIFE" Belt will run in your plant just as straight as this one is doing, and give you the same fine, satisfactory, low-costing service. Try one!

B. F. GOODRICH RUBBER COMPANY, *Akron, Ohio*

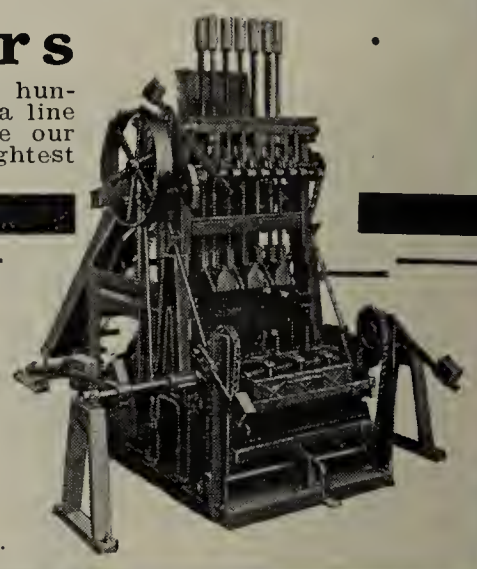
Goodrich

"LONGLIFE" *Conveyor Belts*

"BEST IN THE LONG RUN"

The Advantage That Is Yours

when you deal with us, grows out of the fact that we are an old-established company with hundreds of more-than-satisfied customers in every nook and corner of the U. S. A. We make a line of efficiency products that are absolutely GUARANTEED to user's satisfaction. We value our good name highly and carefully inspect every manufactured unit so that not even the slightest deviation be made from our recognized standard.



Ideal
Trade Mark

Fully-Automatic Building Tile Machines

are a perfect example of the type of product we are turning out, as they are built to serve, and make friends as well as money for the user. Install one of these tile machines which delivers three tile on a single pallet, with no stopping or delay for off-bearing of tile.

The Ideal Concrete Machinery Co.

1338 Monmouth St.
Cincinnati, O.

A clean-cut, graceful, strong, water proof burial vault that sells readily

DON'T SHUT DOWN YOUR PLANT THIS WINTER

Winter is the busy time for the progressive concrete vault maker and the Automatic Sealing Burial Vault is one of the most profitable products you can make—100% to 200%.

In fact, the products maker who goes into the vault business in earnest usually makes more money out of it than he does from all his other products put together.

Equip your plant for a vault business this winter. We'll help you sell the vaults. Write us for complete particulars.

AUTOMATIC SEALING VAULT CO.
216 E. River St. PERU, IND.

—money in vaults

A Building Is As Dry As Its Basement

In excavating for the foundation of this school building in Massachusetts, the contractor encountered several underground springs. In spite of this fact, 2% of *Medusa Waterproofing* added to the cement rendered the foundation walls completely impervious to moisture and dampness.

Keep the underground part of your concrete work free from dampness and you have settled one of your most difficult problems—and right there is where the special structural value of *Medusa Waterproofing* comes in. Ask for full particulars.

THE SANDUSKY CEMENT COMPANY
Dept. E, Cleveland, Ohio

MEDUSA
WATERPROOFING
for CONCRETE

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

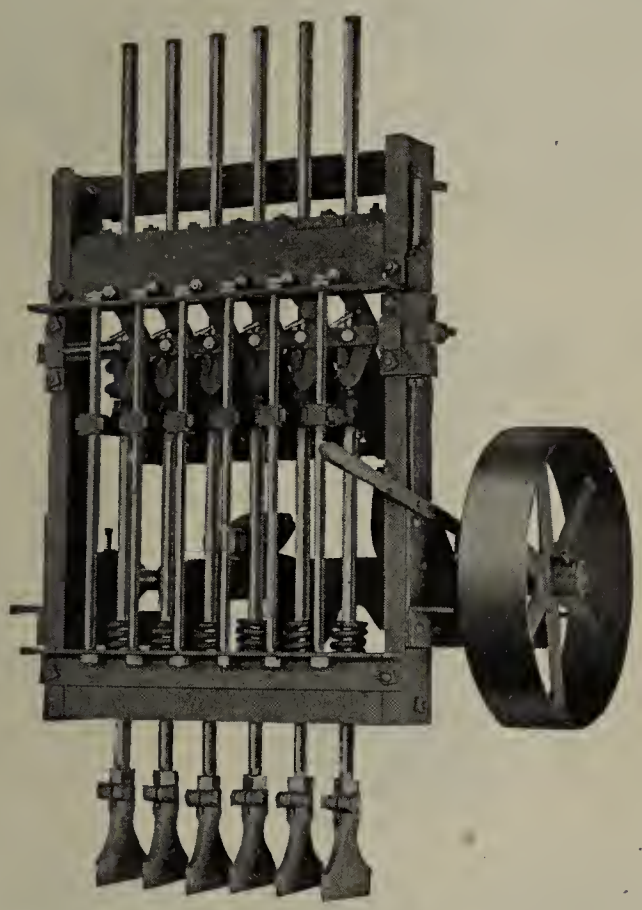
See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

The Ever Increasing Demand For Kent Tampers Reflects Public Preference For Its Unfailing Performance



Experienced concrete products manufacturers know the value of owning a tamper in which every part is made by an old experienced organization of reliability—a tamper that is guaranteed and protected by the manufacturer.

The greatest proof of Kent performance is gained from statements of owners of these tampers, which are operated all over the country. Their story is convincing.

A tamper to be economical must be operated with the least amount of power and it must be so designed that the depreciation is minimized. Such economies are regulated by the correctness of mechanical design and Kent engineers have constantly kept pace with user's requirements.

Post Economy Punch Block Machine

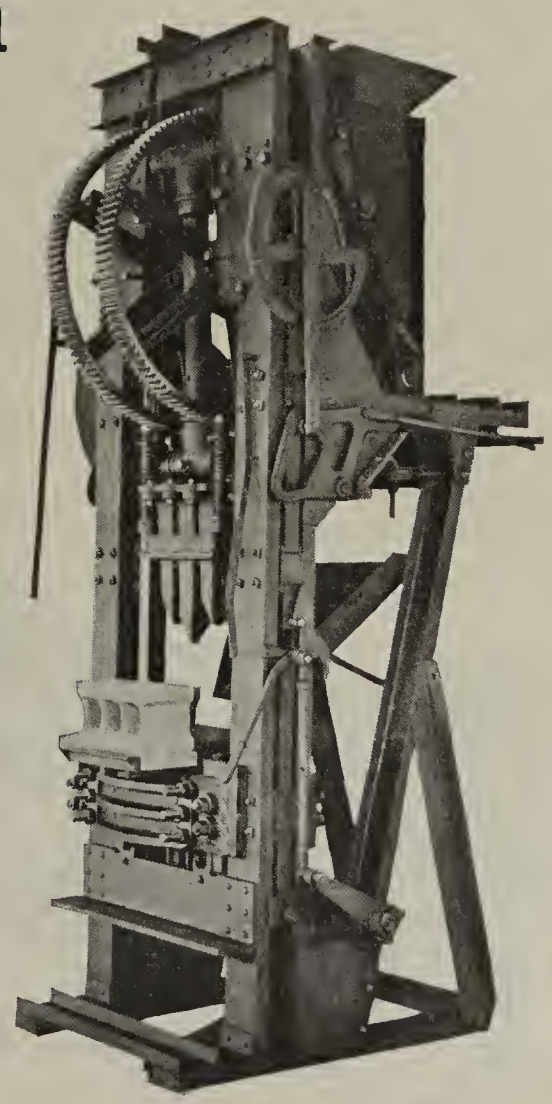
for large production of quality concrete blocks. It is an automatic machine.

Amount of material used in each block is exactly and automatically measured by the machine—exactly the same pressure is applied to each block.

Therefore the blocks are of equal size and density—absolutely uniform, regardless of any inattention or negligence on the part of the operator.

The mighty force of the Post Economy Punch delivers such tremendous pressure upon the entrapped concrete that the resulting block is unusual in its strength and endurance.

That's the block you need to answer the demands of your territory—a fast seller, one that builds homes free from upkeep costs and builds satisfaction among your customers.



RED LINE PRODUCTS

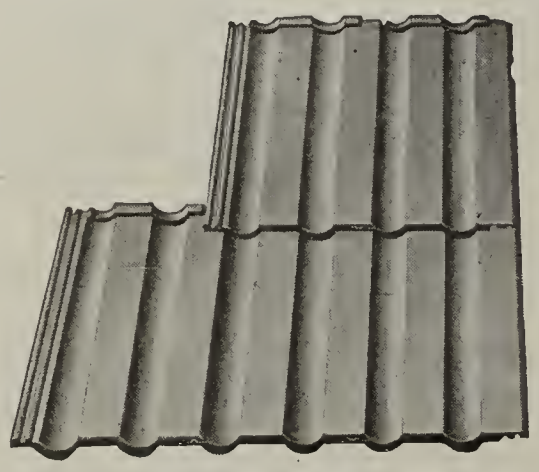
Automatic Tampers	Lift Trucks	Elevating Devices
Block Machines	Continuous Mixers	Electric Motors
Block Cars	Batch Mixers	Gas Engines

KENT MACHINE CO.

CHICAGO OFFICE,
429 MONADNOCK BLK.

KENT, OHIO

YOU OUGHT TO INVESTIGATE THE SUCCESSFUL



FRENCH TILE

developments we have made in the concrete roofing tile manufacture in the way of absolutely PERMANENT COLORING and unique STRENGTH OF THE TILE, performed with our new coloring method and a peculiar pattern of the underside of the tile—specially designed for giving the tile the GREATEST STRENGTH IN ITSELF and for the purpose of REINFORCING THE TILE IF DESIRED.

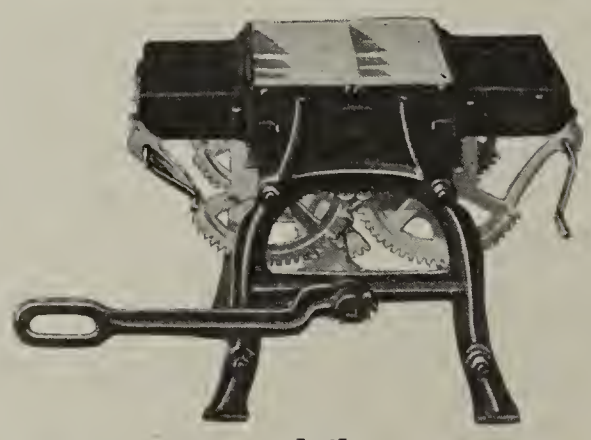
The service we give our customers is thorough and insures you of success when you are entering the concrete roof tile business—using our machines.

Write for the U. S. CHAMPION ROOF TILE BULLETIN

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.

SPANISH TILE



Double your daily output with DOUBLE-SPEED Brick and Block Machines

Now is the time to increase the capacity of your block plant—turn out the maximum number of wall feet per day, while the demand for building materials is at its highest.

Block Output

Our Double-Speed Block Machine makes in each operation: 2 hollow blocks, 2 silo blocks, 2 solid blocks, 2 slabs, 4 half blocks, 2 water table slabs, 2 return ends, 2 chimney blocks, or 2 porch pier blocks.

Brick Output

Double-Speed Brick Machine makes 16 brick at each operation, 8 brick being delivered at each side of the machine.

Double Speed Tamper

This power tamper gives our block machine a capacity of 1,500 blocks per day and speeds the brick machine up to 12,000 brick per day. Roller-cut-off removes surplus material from mold box and finishes the top of the product. The block and brick are tamped rapidly and vigorously, resulting in a dense, strong product. Machine consumes little power and is practically fool-proof.

Write for block and brick machinery catalog, Dept. A,

Wood Bros. Thresher Co. Des Moines, Ia.

THE HOBBS

The multiple oval cores of a Hobbs machine make the use of wet mix possible with no loss of time. The result is a hard, dense, waterproof block—plain for foundations and cover walls—faced for superstructure.

For Catalogs and Prices, write

The Anchor Concrete Machinery Co.

Adrian, Mich.

Rock Rapids, Iowa; Columbus, Ohio.

Easy on the Workers—Easy on the Engine—
Easy on the Bankbook

Biggest Mixer Bargain Ever Offered

REMMEL MIXRITE Concrete Mixer

The World's Best 3½ Cubic Foot Mixer

All Iron and Steel construction with the EXCLUSIVE SIDE GEAR DRIVE, that adds 100% to its worth. Mixer loads or discharges from either side—always in gear when dumping. Strongly built—no wobbling.

The Popular Mixer for

MASON CONTRACTORS
Saves 50% in Labor

CONCRETE CONTRACTORS
Large enough for the average job and small enough to be readily moved. A Money Saver.

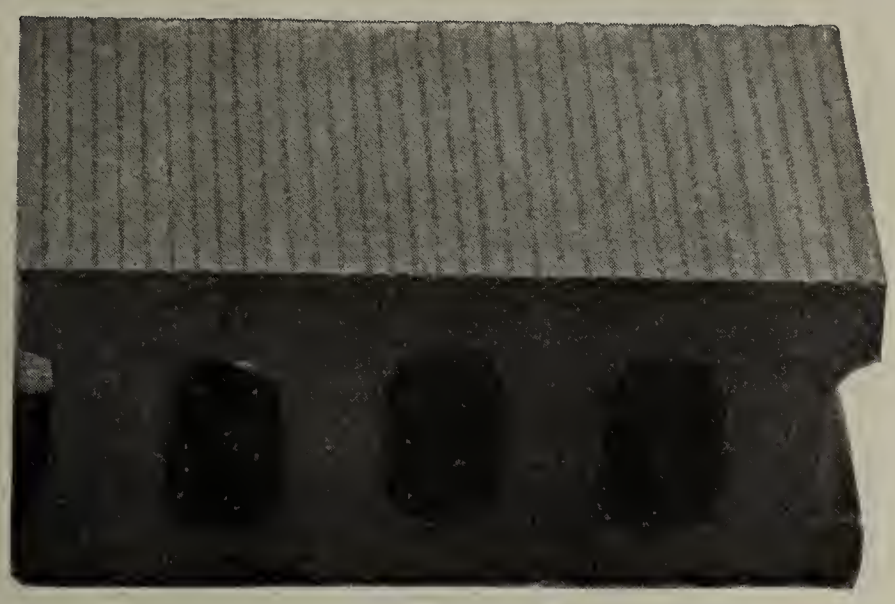
CARPENTER CONTRACTORS
Just the right size for foundations and floors.

TOWNSHIPSS
Just right for culvert and county work.

Sold Under Iron-Clad Guarantee. Write for complete specifications and descriptive circulars. Dealers wanted everywhere.

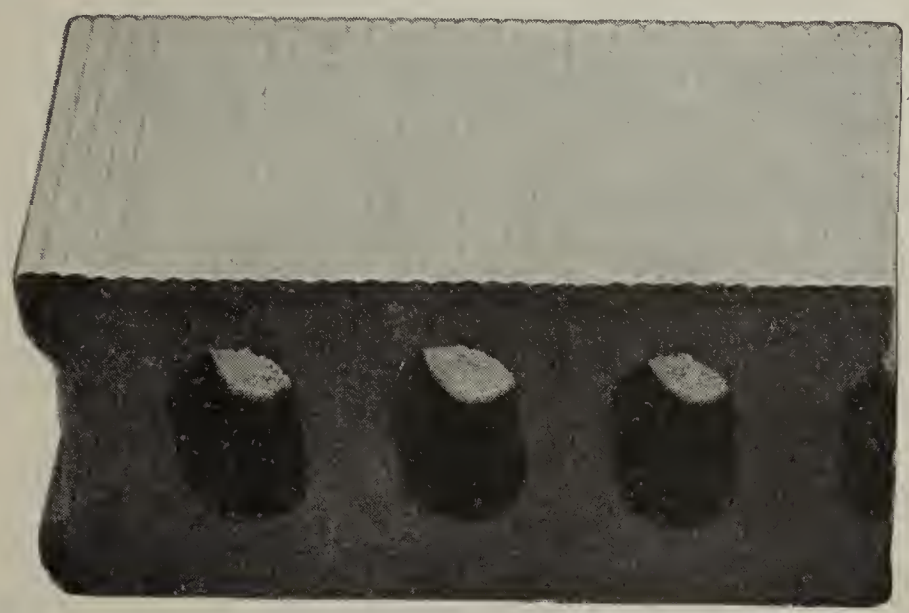
REMMEL MANUFACTURING CO.

Dept. E Kewaskum, Wis.



Show your customers just what two coats of Medusa Cement Paint will do for an ordinary gray block or other portland cement job. It not only gives a beautiful, ornamental finish, but makes a surface that turns water. Try it for yourself—we'll gladly send sample and directions, free.

Just a Few Strokes Turns Gray To White!



Just a few strokes of the brush make the difference between work done in ordinary gray portland cement, and the same piece having a clean, fresh surface of pure white or color. Only a few extra minutes and a few extra cents are needed to give your work an added *selling profit* away ahead of what plain work could ever bring.

Medusa Cement Paint will make the difference. It is a powder, shipped in handy friction-top steel cans, ready to use by adding plain water. Two coats will put a lasting surface, in white or color, on concrete, brick, stone, tile, wood or metal.

And Medusa Cement Paint will *effectively keep moisture and dampness out.* It is a wonder-worker, too, for damp-proofing basement walls; for renewing stained, discolored or cracked stucco; for lining swimming pools and the like; and for a world of uses on the farm.

Use Medusa Cement Paint to push your sales of blocks and other gray jobs. Sample for trial with full information, *sent free.*

THE SANDUSKY CEMENT COMPANY

Department E.P., Cleveland, Ohio

Manufacturers of Medusa Stainless White Cement (Plain and Waterproofed); Medusa Gray Cement (Plain and Waterproofed); Medusa Waterproofing (Powder or Paste) and Medusa Cement Paint.

MEDUSA

· Waterproof · CEMENT PAINT

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Company's Concrete Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

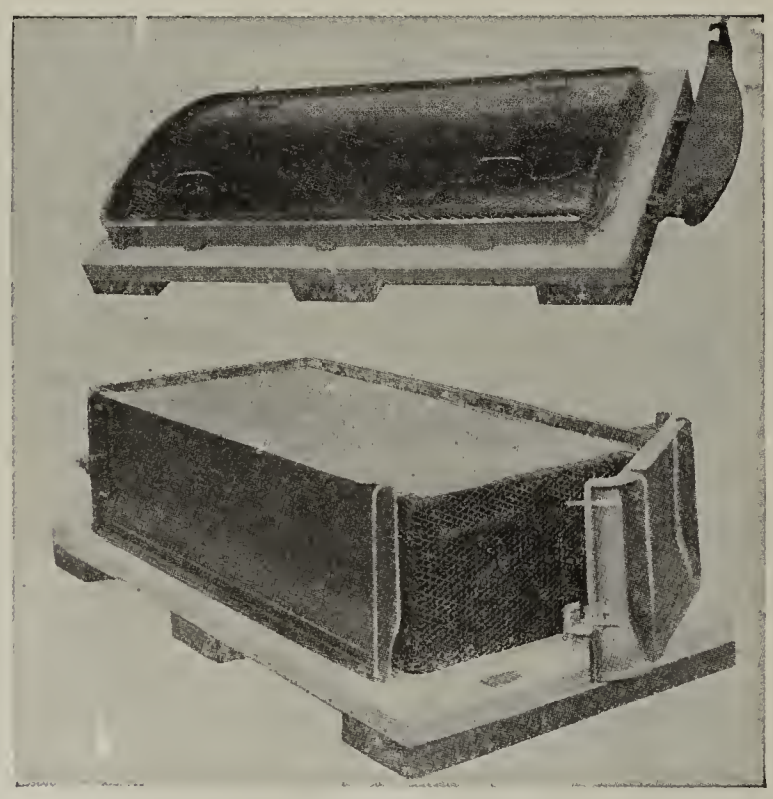
The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,



Get Into the Burial Vault Business

In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault, for which there is a national demand. No royalties; never a failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

CHICAGO CEMENT BURIAL VAULT AND CASKET COMPANY

5301-5-7 Ravenswood Ave. CHICAGO

ONE MAN CAN RUN IT

The Little Whirlwind Concrete Mixer
THE MASTER MIXER
From Factory to You—Save 40%

Only ***real practical*** small mixer producing same ***perfect*** work as most expensive big machine. Complete with hand and power drive. A ***winner*** for the contractor or cement worker. ***All steel and iron.*** Just like the big $500 mixers, only simpler. Just the size you need at a price you'd like to pay. Does your work in one-fifth time.

The Whirlwind Way Makes Mixing Pay

Saves its cost on one job. Capacity about 3 cubic ft. Mixes a batch a minute. Does PERFECT work, wet or dry, empties clean. Discharges direct to forms, cuts out the wheeling and backache. Satisfaction guaranteed or your MONEY BACK. Reference: Any La Crosse bank or Dun Agency. Write for circular or order direct from this adv. and avoid delays.

Patents Pending

Only $64.50

The Little Whirlwind Mixer Co.

45 Gould Street La Crosse, Wisconsin

8 MEN CAN'T STICK IT

SAVE CEMENT

Salvage from 5 to 10 sacks of good cement from each 1,000 empty sacks and reduce labor by one-half—by cleaning them in our

Unit Sack Cleaner

Write us for particulars:

Handy Sack Baler Co.
620 S. 2d St.,
Cedar Rapids, Iowa

Make More Money out of Concrete Work!

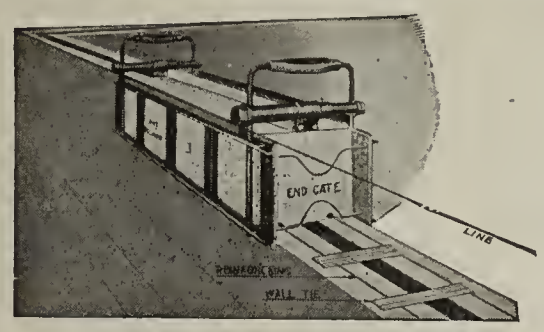
Porch Molds
Brick Machines
Block Machines
Sewer Pipe Molds
Fence Post Molds

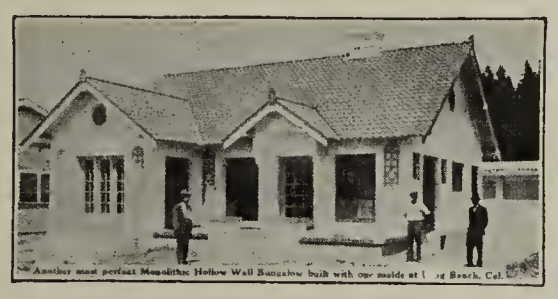
Vase Molds
Block Molds
Chimney Molds
Concrete Mixers
Cap, Sill & Step Molds

Good machinery will speed up the work—cut your costs—increase your profits. We have been concrete equipment headquarters for 16 years. Write for complete illustrated catalog and prices.

CONCRETE EQUIPMENT CO., 540 Ottawa St., Holland, Mich.

For 50% Build the Hollow Wall Way For 50%




Another most perfect Monolithic Hollow Wall Bungalow built with our molds at L[illegible]g Beach, Cal.

Like a Thermos bottle—Warmest in winter, coolest in summer. Fireproof, Everlasting.

Cheapest, Best and Most Perfect way known to the Building World.

The reason the most wall can be built for the least money with our forms is because they are STRONGEST, LIGHTEST, SIMPLEST and most PERFECT and the price of a complete set can be saved on one small job.

Let this building be built so well and so quickly that the owner will be encouraged to build another.

SEND FOR LITERATURE

The Universal Cement Mold Company
224 Villard Ave.
North Milwaukee,
Wisconsin,
U. S. A.

VACUUM GRAVE VAULT MOLDS

make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.

GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE" (Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples
VICTOR BALATA & TEXTILE BELTING CO.
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston
CONVEYOR BELTS A SPECIALTY

FELSTONE

FOR

FACINGS

We are producing for the manufacturers of Synthetic Stone, Concrete Block or Brick, a material containing all the constituents of natural granite.

These are scientifically graded so as to furnish the densest possible aggregates of varying textures.

White Felstone Crystals for Stuccodash cannot be Surpassed.

The Southern Spar & Mica Company

HAYWOOD BUILDING
ASHEVILLE, NORTH CAROLINA

Every Engineer and Contractor

Should know Greenstone Dust. A material available in large quantities at a low cost. It increases the Tensile Strength of Concrete at least three times. Is a natural waterproofing. REPLACES economically the dull gray look of Concrete, and makes it a beautiful soft Olive Green.

Greenstone Dust for sidewalks, floors, concrete walks, foundations, Pillars, flower boxes, burial vaults, wherever cement is used.

SEND FOR SAMPLE, STATING PURPOSE

TRITSCHLER & SONS, INC.
220 W. 42nd St., New York City
Sales Representatives:
GREENSTONE PRODUCTS COMPANY, Incorporated

Big Money in
UNIT SYSTEM SEPTIC TANKS

For exclusive territory and molds write

WM. DE LHORBE, Oregon, Ill.

MAKE YOUR OWN
FADELESS CEMENT COLOR
GREEN, BLUE, YELLOW, ETC.
Install such department in your Cement, Brick or Tile Plant, full particulars upon request.
J. ENDLER, Chemist
1014 W. 87th St. Chicago, Ill.

WHITESTONE

——FOR——

CONCRETE PRODUCTS
STUCCO DASH TERRAZZO
MARBLE DUST

We manufacture from WHITESTONE MARBLE and grade to proper sizes; Dust, Sand, Granito and Stucco Dash.

Shipments in carlots or less than carlots in straight or mixed sizes.

Bagged or in bulk.

Samples and prices on application.

Colors: White only.

NORTH GEORGIA MARBLE PRODUCTS CO.
WHITESTONE - - - GEORGIA

SELECTED WHITE SAND

UNEXCELLED FOR

Facing Concrete Blocks, Ornamental Concrete Stone, Hard Plaster, Finishing, Exterior Plastering, Roofing, Stone and Marble Sawing, etc.

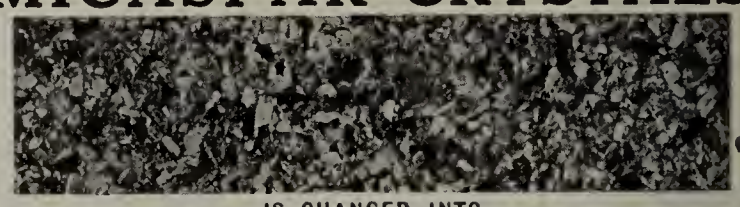
Prices, Freight Rates and Samples on Application
Shipped in Paper Lined Box Cars
Small Shipments in 175-lb. Bags

Ottawa Silica Company
OTTAWA, ILLINOIS

CONCRETE

BRIDGES, BRICKS, BLOCKS, BUILDING TRIM, POSTS, ORNAMENTAL WORK, CAST STONE, ETC.
WHEN TREATED WITH

MICASPAR CRYSTALS



IS CHANGED INTO

A SPARKLING GRANITE FACE

BEAUTIFUL, ARTISTIC AND EVERLASTING

Adds to your product a selling value five times greater than the facing cost.

Made in six scientifically milled sizes, extremely hard, sharp and free from dust and impurities. Insures strength and beauty. Bookiet, "Micaspar and How to Use It," with free samples, mailed on request.

Crown Point Spar Co., Inc., 101 Park Ave., N. Y.

Cement and Engineering News

Vol. 34 Chicago, DECEMBER, 1922 No. 12

How the Cement Industry Seeks to Increase the Efficiency of Its Product

To acquire all possible knowledge about cement so that the consumer may know how to use it most intelligently and economically, the Portland Cement Association carries on exhaustive research work. Its sole purpose in this is to increase the efficient use of its product. To that end it co-operated financially and otherwise in establishing the Structural Materials Research Laboratory at Lewis Institute, an engineering college in Chicago.

The operation of this laboratory is a striking example of co-operation between an engineering science and an industry.

Prior to 1914, when this laboratory was established, there was little or no exact knowledge as to the principles to be followed for obtaining the maximum value and efficiency from the use of cement.

Individual companies had skilled chemists and engineers engaged in research intended to develop improvements in manufacturing processes and the quality of cement itself; but little had been done to develop the making of concrete as an exact science. Now not only the Lewis Institute Laboratory, jointly operated, but individual companies are spending large sums on problems of use as well as manufacture.

Professor Duff A. Abrams, considered one of the highest authorities in the country on the use of cement in concrete, was selected to head the Structural Materials Laboratory.

The only instructions given him were:

"Find out everything there is to know about concrete."

No time limit was set as to when he should begin to produce results.

Funds were provided to carry out the most exhaustive investigations possible.

So thorough and final is this research that five years elapsed before the first laboratory bulletin was issued.

As a result of this first report some beliefs previously held regarding the effect of water in concrete were completely revolutionized.

These investigations made possible the attainment of a substantial increase in strength in concrete without increasing the amount of cement used.

The investigations are being carried out by a staff of enigneers, chemists and assistants who give their full time to this work.

The laboratory's report embody results of thousands of most exacting tests, covering long periods of time. Tests are made to establish facts—not to prove theories.

All findings of the laboratory are made available to everyone without charge in the form of papers before engineering and technical societies and in circulars and bulletins issued by the Laboratory and the Portland Cement Association.

The aim of the Laboratory is to assist the purchaser of cement in the proper use of the material so that it may serve most usefully and economically.

Sometimes these tests show that past practice has been wasteful of cement. Free circulation of such information shows the economic value of such research. In many instances these investigations have led to recommendations which have resulted in a dollar's worth of cement performing the service which formerly required two dollars' worth.

The Portland Cement Association was organized to improve and extend the uses of cement and concrete and to further the best interests of cement users. One of the ways in which the Cement Association exercises its functions is well illustrated with the work of the Structural Materials Laboratory.

Winter Months Offer Bargain Counter to Builders

More Americans are flocking to the building bargain counter this fall than at any time since the war halted home construction. Contractors and architects, usually the first to feel the approach of cold weather with a slump in business, report a steadily increased volume of inquiries and city officials are writing more permits for erection of homes.

Men in the building industry, from material manufacturer to carpenter and mason, have long known the economic advantages of building in the "slack season." For several years the industry has waged a steady campaign to bring this fact before the public and spread the congested activity of a few months over the entire year.

When the greater portion of building is crowded into seven months, prices reach their highest in the spring and summer when the demand crowds supply. The same situation obtains in the labor phase of the work.

By building in the fall and as far as possible into the winter, this demand is more nearly proportioned among 12 months of the year; mills and factories are able to maintain a steadier flow of production; raw material is stabilized; workmen are not shifting jobs so often, and the contractor and architect are able to keep their basic organizations intact, thus decreasing overhead expenses and assuring more satisfactory and efficient work.

Men in the industry see in this autumn's increased building, the prospect of a broadening of the old short season and a consequent stabilization of building costs, estimating that the certain success of the home owners who are building this winter will prompt many others to take the step in succeeding seasons.

The manufacturers of cement particularly have waged steady campaigns on this one subject, in perfecting methods of using their product in cold weather to the best advantage, and to bring a realization of the savings to be effected before the public.

That such campaigns have borne fruit is evidenced in reports for proposed construction from many cities which show a greater volume of all classes of building on the books for fall and winter than ever before.

Accidents at Stone Quarries

Accidents at stone quarries throughout the United States in 1921 resulted in the death of 100 employes and the injury of 10,465 others, according to figures compiled by the Federal Bureau of Mines.

The average number of men employed in quarries was 77,185, who worked a total of 17,987,547 shifts, an average of 233 work days per man. Based upon a standard year of 300 days, the reports show a fatality rate of 2.00 per thousand employes and an injury rate of 174.55. For 1920, the corresponding rates were 2.31 killed and 145.51 injured.

Accidents during 1921 were distributed as follows according to kinds of stone quarried; cement rock, 20 killed and 2,233 injured; granite, 18 killed and 940 injured; limestone, 58 killed and 5,248 injured; marble, 6 killed and 406 injured; sandstone and bluestone, 3 killed and 374 injured; slate, 4 killed and 385 injured; traprock, 11 killed and 879 injured.

The principal stone-producing states, the number of persons employed and the number of accidents in each were: Pennsylvania, 14,994 employes, 1,914 accidents; Ohio 4,570 employes, 726 accidents; Indiana 4,434 employes, 602 accidents; New York 4,357 employes, 827 accidents; Vermont 4,130 employes, 361 accidents; California 3,719 employes, 684 accidents; Illinois 3,241 employes, 515 accidents; and Missouri 3,079 employes, 415 accidents.

Most of the accidents inside the quarries were caused by handling rock at face, flying objects, falls or slides or rock, haulage, and machinery. At the outside rock-dressing plants and crushers, the main causes of accidents were flying objects, machinery, falling objects, hand tools, and falls of persons.

New Catalogs "Dodge" Gears and Chains

Two new catalogs of products used a great deal by cement, gravel, lime and crushed stone producers have been issued by the Dodge Sales and Engineering Co., of Mishawaka, Ind. One of these is entitled "Dodge Gearing" and contains 120 pages of valuable information on all types of gears, and the other is on "Standardized" Elevators and Conveyors and Industrial Chains, and has more than 150 pages of illustrations, tables, and instructive reading matter. This company now has a complete line of conveying and transmission machinery.

Pebble Dashed Farm Homes Are Pretty

By E. V. Laughlin

Fifteen years ago buildings with pebble dashed or stuccoed exteriors were not unduly common, and the few that were seen were invariably in the cities and larger towns. Now they have become popular everywhere. In many rural sections one finds such buildings taking the lead. During the past few months the writer has traveled through a considerable portion of the state of Iowa. On every hand there are evidences that country folks are looking with approval upon pebble dashing as desirable. A vast number of new homes are being finished with such exteriors; and in the case of old homes remodeled or repaired nine out of every ten are provided with this exterior stone and cement. At least this is what the writer detects as he travels here and there through the rural sections.

At first farmer folks were dubious about the sticking qualities of pebble dashed exteriors. Always there was the fear that the cemented covering would crumble under the effects of continued rains or that it would crack and peel off. Slowly, however, they have become convinced that such exteriors are durable and lasting. The advancing price of lumber no doubt has helped bring about this change of sentiment. However, this may be farmers are now fully converted to the advantages of pebble dashing. Now and then one observes barns and poultry houses finished in this way. And without exception one hears no regrets or expressions of disapproval. Of a truth the stone-cement exterior has become a fixture.

It is remarkable how handsome pebble-dashed form dwellings appear. Usually drab, brown, and gray are the favorite colors. Invariably travelers and tourists are heard to remark how great an improvement such exteriors are over the plain pine siding that until recently has characterized all farm dwellings. And with the beautifying of the farm homes there has come a greater pleasure in farm life. It is a noticeable fact that the yards surrounding these trim homes are usually better kept than those surrounding the ordinary homes. It is only an evidence of the truth that an improvement in one part of a farm invariably induces other improvements.

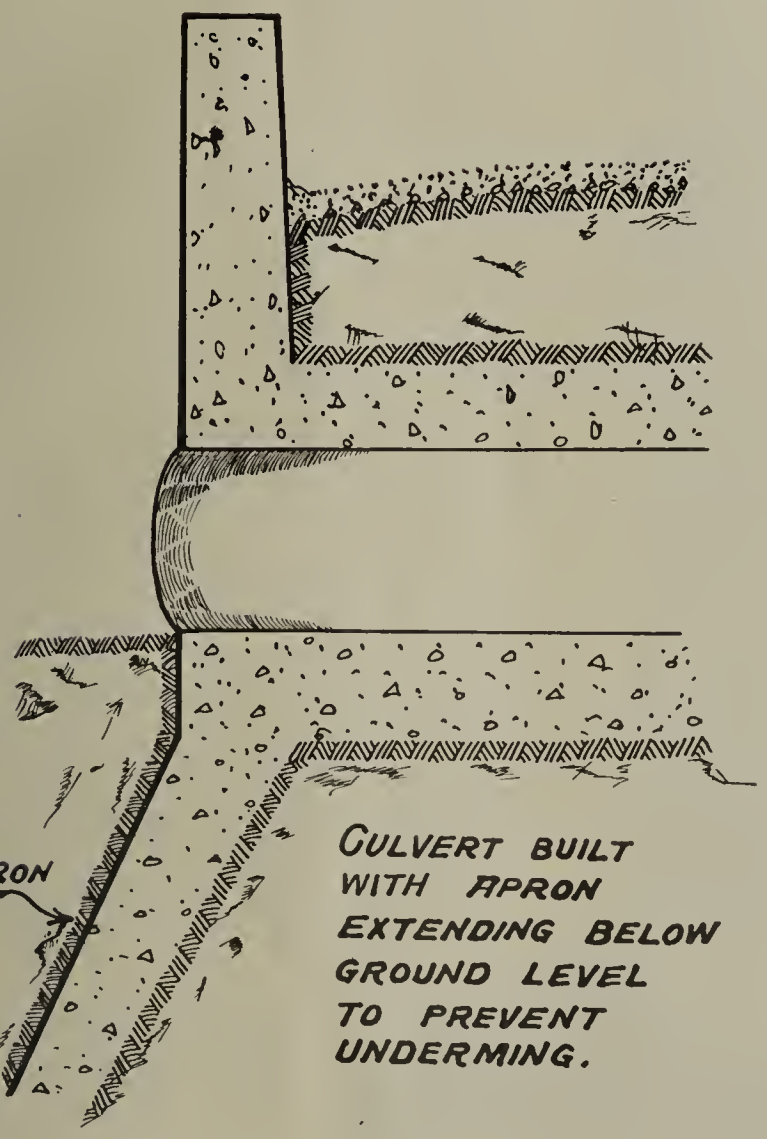
Quite a number of farmers make use of pebble dashing as a means of increasing the warmth of their homes. The surface is lathed without removing the siding. The lath are laid on obliquely and are nailed directly to the siding. Ornamental molds are run along the corner boards and the drop boards and around the window and door frames for the mortar to finish against. Finished in this way old dilapidated houses take on a brand-new appearance. In addition to being much warmer in winter such houses are decidedly cooler in summer.

The writer believes that builders and contractors who are consulted about the remodeling of farm homes will do well to direct the attention of the owners to the advantages that come from pebble dashing. Unquestionably the method is one of the best and cheapest ways of beautifying old homes.

Prevention of Culvert Undermining

By James A. Harvey

Undermining is one of the hardest faults to overcome in culvert building if not properly worked out. Oftentimes the culvert opening is placed beneath the lowest possible water level, thus preventing it from being undermined. But this gives rise to another problem—filling in. When placed too low, the



CULVERT BUILT WITH APRON EXTENDING BELOW GROUND LEVEL TO PREVENT UNDERMING.

neighboring earthwork is gradually worn away, settling itself in the tunnel until it becomes practically filled. If the water displacement of the tunnel is of just the correct size when built, the drainage becomes inadequate by reason of the opening becoming partly filled with sediment. This causes the water to "back up" until it has reached such a height that it overflows the road, causing washouts.

When a culvert is built too high (above the usual water level) with no apron projecting below to hold back the water, the steady worry of the water to the surrounding bank in its whirlpool motion soon digs under the culvert until the end of the heavy structure is suspended in mid-air, so to speak, the whole weight being carried by the opposite well-anchored end on the opposite side of the road.

In placing culverts, sound judgment is essential, and correct water displacement is absolutely necessary. A better policy to follow is having a greater number of square feet displacement than is required rather than too few. The test comes during the rainy season and to learn that the water-flow has been underestimated, resulting in serious damage to the road, is not good engineering practice.

Build the open end of the culvert, especially the one which is the inlet, on a level with the bed the water occupies. To protect the end of the job from future changes, provide for a cement apron, which is poured along with the rest of the culvert. In some cases the apron should extend deeper, well below the ground level. The proper angle depends on the density of the ground and the force at which the water is thrown against it. The illustration in the left column gives a general idea of the construction.

In cases where the stream strikes the end of the culvert at an angle and with such rapidity that it is likely to change its course a perpendicular apron should be constructed at such an angle and long enough to guide the water into the opening.

The accompanying photographic view illustrates a case of undermining in its infancy. Here an apron

would save the end of the culvert and prevent the bed of the stream changing. As the construction now stands, the outflow of the water causes a constant whirlpool at the mouth of the culvert.

Concrete Oil Tanks

Contract has been awarded to Bent Brothers, 1714 Eagle Street, Los Angeles, at $.80 per cu. yd. for the excavation work in connection with the construction of a 1,000,000 barrel reinforced reservoir for the Shell Oil Company to be located at Martinez.

AN EXPERIMENT *in the* DECORATION of CONCRETE SURFACES

Photographs Copyright by The Architectural Record

"The Polychrome Sculpture in relief upon the walls is essentially a world of out-of-doors, of large, swift moving animals, of exhilarating movements and vigorous rythm"

Here is a revived problem, the decorative use of "this age-old material that has come back into our life like some old Leviathan, a crude, shapeless mass that we must mold to our purposes, into the character of our life," so says Antoinette Perret in reviewing this work in *The Architectural Record.*

The cement wall surrounds a small garden near Mr. Rumsey's studio, on the edge of sloping fields, and just across a little lane from his stables where are kept his hunters and his polo ponies. The garden is not finished. It is to have an oblong cement swimming pool, and some furniture from designs by Mr. Rumsey, but it will contain no vines nor flowers. All the color is to be supplied from the bright relief along the wall. There will be fountains at the ends and there are already tall evergreens, but the planting will be chiefly low ground-covering pachysandra and myrtle, with ferns and evergreen andromedas and cassandras with the fountains flanked by prostrate junipers and spreading yews.

On the outer wall, the end wall, is a horse trough with an arched panel and small medallions of hunters and animals

"Each Panel is in a different color scheme"

A GARDEN WALL~ CREATED BY CHARLES CARY RUMSEY, *Sculptor* ~ ON HIS ESTATE IN THE WHEATLEY HILLS, L.I. (Courtesy of *The Architectural Record*)

inserted on either side. It all has spontaneity, a sense of playfulness that marks it as a sketch rather than as a finished work—yet it is important as sculpture.

In putting the colored concrete into moulds we come upon the first problem from a sculptor's point of view. The relief must be simple and broad and not too tight. One of its very charms must come from a softening and blurring of the outline, and this through the rough and sandy nature of the concrete.

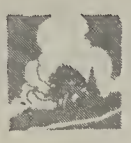
The colors are handled simply and flatly as in a poster. There is white and black, putty color and sand, a soft green and a soft gray-green, a light and a deep wash blue, a gold color, a terra-cotta, and a prune for tree-trunks. A charming shade of washed-out pink is sometimes used for earth and sometimes for the sky.

"In mixing his color with the cement, Mr. Rumsey has obtained the effect he sought and it now remains to be seen what influence the weather will have upon the work. One panel has been out in the open for five years and has borne the exposure absolutely well, which is a good augury."

"Each Panel represents a world of its own"

JMR

"In Mr Rumsey's use of brilliant friezes on the flat surface of concrete, we have a means of decoration that is in keeping with the material used and thoroughly expressive of modern life"



Areaways Increase Efficiency of Buildings

Areaways built up outside of basement windows serve a two-fold purpose. They make possible a large amount of light through windows ordinarily arranged,and they reduce the dampness of basement walls. Either of the two points mentioned should be sufficient inducement to add this detail, provided the cost is not excessive. When both advantages are combined there is a strong argument in their favor.

Such practice is coming into its own, though many small buildings lack this detail which would otherwise render them far more serviceable and remunerative. The views here shown illustrate the way in which the new Agricultural Engineering Building on the Farm Campus of the State University of Lincoln, Nebraska, has been arranged. The areaway walls are cemented up from a depth one foot above the basement floor

within. The space between the outside of the building and the inner surface of the walls is about seven feet. Each end is built three feet higher than the level of the grade line and the longitudinal walls are about one foot above the ground.

Stout 4-inch iron pipe railings with posts to match are bolted to the cement work to protect the edge and to insure the safety to passersby.

One of the views shows the manner in which the areaways have been floored. Concrete was laid four inches thick on lrmly tamped earth with two drains leading to the sewer. The line of the shadows shows, relatively, the amount of light which ordinarily strikes the basement windows. In a commercial building of this type this feature would add a tidy sum to the amount for which the building would be rented.

—Dale R. Van Horn.

Fence Posts Offer Business Opportunity

The increasing number of requests for information on concrete fence posts that are being received from land owners clearly indicates that there are possibilities in manufacturing this product, and that the farmer is slowly but surely coming back into the market. Manufacturers who are contemplating adding any products to their present line can well afford to investigate this field.

Like everything else the concrete product that would be the best seller depends almost entirely upon the community. In certain localities, fence posts might be the poorest possible thing to attempt to introduce. Thousands of dollars are invested in idle equipment all over the country today. A large portion of this money could have been saved if investors had only carefully analyzed their local markets before venturing into new fields. Therefore, if you plan to try fence posts, or any other product, study your market. You can well afford to spend considerable time and money investigating and still be ahead.

An Exceedingly Interesting Account of the Early History

of Quarrying, Tracing Its Development from the Early Days of the Egyptians and Greeks Up to the Present Time*

The effectiveness of any explosive, is largely dependent upon the proper placement of the bore holes, and drilling, therefore, is of great importance. Drilling and blasting are so interdependent that one cannot make a proper plan for placement of drill holes without first considering the grade strength of explosive which the bore holes are to receive.

Where there are numerous open joints the problem of drilling becomes complicated. Fissures in the rock tend to slow down the speed of drilling as well as making it more difficult. Furthermore, an open seam provides an avenue of escape for the gases from the detonated explosive charge, thus reducing the effectiveness of the shot. It is usually advisable to abandon a hole cutting such seams or cavities, as the cost of drilling in unsound rock is thereby increased.

If these joints are irregular and change in direction abruptly, many useless holes may be drilled unless systematic measurements of the joints are made with compass and clinometer and then carefully plotted on paper. Undoubtedly a chart of all the joints containing all the information possible is of great assistance in locating drill holes and avoiding the drilling of useless holes.

Primary and Secondary Blasting

The success or failure of a quarry may be determined by the study and attention given to blasting. Blasting at quarries may be considered under two distinct heads—primary blasting and secondary blasting.

Primary blasting refers to all shots made in the quarry ledge in its original position for the purpose of breaking down portions of the ledge into different sizes. Secondary blasting is that which is necessary to break up the larger rocks obtained from the primary blast into sizes small enough for subsequent handling for loading or crushing.

No problem which the quarryman encounters requires a greater amount of careful study to obtain satisfactory results than does primary blasting. This is due to the many varying conditions encountered in different sections, in different formations at the same quarry and at times irregularities and sudden changes in an individual formation at different points in the same quarry.

The chief variable factors affecting primary blasting are listed by the U. S. Bureau of Mines (Bulletin 160) as follows: (1) Height of face; (2) hardness and uniformity of rock; (3) altitude of beds; (4) prevalence of open bedding seams and joints; (5) altitude of quarry floor; (6) size and depth of drill holes; (7) arrangement and spacing of drill holes; (8) number of holes shot at one time; (9) size of charge; (10) position of charges in drill holes; (11) type of explosive used; (12) method of firing shots; (13) method of loading rock; (14) size of crusher. Each of these factors are considered by the careful quarryman in his blasting operations.

Straight Nitroglycerin Dynamite

Nitroglycerin dynamite is the standard by which all high explosives are measured on a weight-for-weight basis, therefore it should contain the actual amount of liquid nitroglycerin designed by its percentage strength. Its high rate of detonation makes it a good explosive to use where a strong shattering effect is desired. It resists water well, a valuable asset where wet holes are encountered.

Extra or ammonia dynamite has the same strength grade-for-grade as straight nitroglycerin dynamite. While its rate of detonation is not quite so high, it is a quick explosive. Its explosive base consists of nitroglycerin and ammonium nitrate. The latter will not resist water very long, but the cartridges of extra dynamite are dipped a second time in paraffin after they have been filled and the ammonium nitrate itself is coated with water-resisting compounds, so they will withstand the action of water for a considerable time if they are not split in loading. Extra dynamite is not as sensitive to friction or sparks as is straight dynamite.

Gelatin

When a small amount of nitrocotton is dissolved in nitroglycerin it forms a jelly-like substance which is a stronger explosive than pure nitroglycerin. When various absorbent materials are added the result is a plastic explosive denser than ordinary dynamite. Because of this density a given weight of gelatin can be confined in a smaller space than would be required to contain an equal weight of straight nitroglycerin or extra dynamite. This quality makes gelatin a decidedly advantageous explosive to use in hard, tight formations where a concentrated charge at the bottom of the bore hole is desired. Gelatin has a lower rate of detonation and, hence, is less shattering in its effect than straight nitroglycerin dynamite. However, when fired with cordeau, its quickness is increased.

Gelatin, extremely water resisting, is the best explosive to use when the explosive remains under water for a considerable time during loading operations. It is also unexcelled for underground work, because of its plasticity, density, imperviousness to water and good fumes.

Modern Methods of Firing

The introduction of electric blasting caps and cordeau detonating fuse were important contributions to the advancement of quarry blasting. A great increase in efficiency is obtained by firing a number of holes simultaneously over that of firing them individually.

Electric blasting caps furnished the first effective method of simultaneous firing. By placing one or more of these caps in each hole and connecting them all to a power circuit or blasting machine, large numbers of holes may be effectively fired. When this system is employed and there is a high column of explosive in the hole, as in well-drilled holes, it is advisable to place several electric blasting caps at intervals in the charge to prevent the wave of detonation in the explosive from decreasing in velocity as it travels along the charge.

The straight parallel connection is the best for electrical blasting if there is sufficient current and voltage to put the current through the circuit. The reason for this is that some caps are more sensitive than others and in anything but a parallel connection the more sensitive ones may fire first and break the circuit. In the straight parallel connection each cap is independ-

*Paper delivered by N. S. Greensfelder of Hercules Powder Co. at the annual convention of National Crushed Stone Assn.

ent and should fire regardless of the other caps. The parallel connection can not be used with a blasting machine because of the high current required. When the firing is done from a power circuit with sufficient current the parallel connection is the best.

The next best connection, and one which is good when sufficient current and voltage for the straight parallel connection is not available, is to have the caps connected in groups, and have the caps in each group in parallel and the groups themselves in series. The number of caps and groups is dependent on the available current and voltage. The greater the number of series and the fewer the caps per series, the closer it approaches the straight parallel connection.

However, when a blasting machine is used to fire the blast, the straight series connection should be used because there is not enough current developed to fire a large number of holes, connected in any of the other methods described.

A more recently developed means of detonation is with cordeau. This consists of a carefully drawn lead tube filled with trinitrotoluene. The three principal advantages claimed for cordeau are safety, instantaneous detonation and increased efficiency from the explosive charge.

Cordeau is so insensitive that it cannot be set off by friction, fire or any ordinary shock, but requires for detonation an extremely violent shock, such as that produced by a blasting cap. The average rate of detonation is about 17,500 ft. per sec. Therefore, when it is placed along an explosive charge, the entire column is detonated at a rate equal to that of the cordeau. The increase of the rate of detonation thus obtained, particularly with the slower dynamites, increases their shattering effect and consequently decreases the cost of secondary blasting.

Where the explosive charge is placed at different points along the hole, cordeau furnishes a particularly convenient and efficient means of detonation. When loading a deep hole with cordeau, run an iron bar through the hole in the center of the spool on which it is wound. Lace the end of the cordeau through a dynamite cartridge, which acts as a weight in lowering the cordeau down to the bottom of the hole. When the dynamite cartridge reaches the bottom, draw the cordeau taut, so that it will lie along the side of the hole and not interfere with further loading. The explosive charge can be broken as many times as desired because the cordeau will detonate throughout the entire length of the hole. The cordeau is then cut off a short distance above the top of the hole, and the end weighted down by a loose stone to hold it taut during the loading.

When all the holes are loaded and the surface cleared for the shot, the main line of cordeau is unreeled across the tops of the holes and the cordeau in each hole is connected to the main line. This is done by slitting the piece of cordeau which extends from the hole and twisting the ends tightly around the main line. When all the holes are connected to the main line a blasting cap or electric blasting cap is connected to the end of the main line. The firing of this cap detonates the entire blast.

Always arrange the main line of the cordeau so that the detonating wave reaches the row of holes next to the face of the quarry first and then the other rows in the order they recede from the face.

It is well, whenever possible, to make a complete circuit of the main line so that every row of holes will have two ways by which the detonating wave can reach it.

Power Scrapers and Excavators

Sauerman Bros, 1139 Monadnock Bldg., Chicago, Ill., have issued Pamphlet No. 16 entitled Sauerman Bottomless Power Scrapers, which are operated by a two-drum hoist. A wire rope is attached to the front bridle of the scraper bucket and this cable, called the load line, extends across the dumping point to a guide sheave and thence to the front drum of the hoist. Another cable is attached to the back of the scraper and extends to a tail block at the back of the excavation and from there to the rear drum of the hoist. The scraper will dig or dump to any desired point. Fine pictures show these scrapers at different kinds of work and the reading matter give full particulars about them. Pamphlet No. 17 issued by the same firm tells all about their dragline cableway excavators and especially concerning how they are used in handling sand and gravel. This type of cableway consists primarily of a scraper bucket attached by flexible chain connections to a carrier running on an inclined track cable, the cable being supported at its upper end by tension blocks to a well-guyed mast and anchored at the lower end to a movable A-frame or bridle anchorage. The maximum econmical span is from 500 to 800 feet, but spans up to 1000 feet are being used. A load cable is attached to the front of the bucket and carrier, this cable loading bucket and conveying it along the track cable to the dumping point. A tension cable operates the tension blocks at the top of the mast. There is a diagram to show the operation of the entire device. There are many good illustrations showing these excavators at work besides other pictures showing different types of buckets, etc.

European Cement Market

Belgian and German cement makers have succeeded through the policy of price cutting in almost completely arresting exportation of the French product in the last three months, according to reports received by the Iron and Steel Division of the Department of Commerce. The factories at Boulogne-sur-Mer, the largest cement manufacturing center in France, are capable of producing 600,000 tons annually or about three-fifths of the total French production. Conditions in this region are typical of the situation throughout the entire industry. It is estimated that the cement industry during the last week of July was working at about 80 per cent of normal, whereas the first weeks of the month it was only working at 70 per cent.

French exporters are still shipping a small quantity of cement which they are content to sell at the cost of production. The causes for the differences in prices include the application of the French eight hour day law, the high freight charges and the high cost of coal.

An authority on the French cement industry said, "Unless the factories in the Boulogne-sur-Mer district can sell their products abroad they will be forced for a time to reduce their force and probably close their doors. The situation has improved somewhat during the past few months but it is still dark for us. We have one great hope—that the superiority of our products will eventually predominate and that we will regain the markets we are now losing."

Counsel for Cement Association Corrects Certain Misstatements

What he declared are misstatements in the New York World's articles on tariff, especially in respect to cement, were pointed out recently by William J. O'Brien, Jr., counsel to the committee on tariff legislation of the Portland Cement Association:

"In its article of May 29, the World refers to a group of 'super-lobbyists' under whose direction 'the rates of the (McCumber) bill have been jacked up an average of 50 per cent above the levels of the Payne-Aldrich tariff,'" said Mr. O'Brien.

"The facts are that the duty on cement under the Payne-Aldrich bill was eight cents per 100 pounds; 50 per cent of this duty would be 4 cents per hundred pounds; therefore, if cement was granted a duty under the McCumber bill of 50 per cent above the duty provided under the Payne-Aldrich bill, the duty would be 12 cents per 100 pounds—whereas, as a matter of fact, the McCumber bill provided for 5 cents per 100 pounds.

"The world complains that 'high duties are proposed on cement, brick and other buildings materials formerly on the free list, which would add to the already exhorbitant building and housing costs.'

"In housing operations, the cement used represents on the average about two per cent. of the total cost of building. A difference of 20 cents per barrel (the proposed duty) makes a total difference of about $10 for each $10,000 spent in building.

"The World in its article of June 5 makes the statement that the Senate Finance Committee proposed to make it possible for the cement industry to 'take tens of millions of dollars from those who construct homes and other improvements.'

"If this duty takes $10,000,000 from those who build homes, $10,000,000,000 will have to be expended in such construction. This statement is obviously absurd.

"The World says:

"'While the amount looks harmlessly small (five cents per 100 pounds), experts reckon that the duty would allow the price to the consumer to be boosted at least 20 cents a barrel; and based on 1920 production of 100,000,000 barrels, that would reach the significant total of $20,000,000 a year as the special bounty to be gouged from the public and awarded the Cement Trust.'

"The writer assumes, of course, that the price would increase 20 cents per barrel provided the duty was placed at 5 cents per 100 pounds. This is purely speculative and there are no figures to sustain it.

"In 1900 the duty on cement was 7 cents; the price was $1.09.

"In 1901 the duty on cement was 8 cents; (Payne Aldrich bill) the price was 99 cents.

"In 1913 cement was placed on the free list; the price was $1.00.

"In 1914 with 'free' cement the price was 92 cents.

"In 1915 with 'free' cement the price was 86 cents.

"In 1916 with 'free' cement the price was $1.10.

"In 1917 with 'free' cement the price was $1.35.

"In 1918 with 'free' cement the price was $1.59.

"In 1919 with 'free' cement the price was $1.71.

"In 1920 with 'free' cement the price was $2.01.

"These figures certainly afford no basis for the statement that the tariff of 20 cents a barrel would boost the price to that extent.

"During the cut-throat competition existing in the years 1912, 1913, 1914 and 1915, cement was sold below the cost of manufacture. Many persons seem to consider that the prices prevailing during these years establish a fair price for cement, without taking into consideration that owing to unfortunate conditions, the product was sold during those years below cost, and totally disregarding the fact that the cost of manufacture has materially increased.

"The World says further:

'According to the experts who are making a study of the invisible taxes which the Fordney-McCumber Bill means for the public, the cement duty as planned virtually was an invitation to the Cement Trust to continue profiteering at the expense of the public and a guarantee of extortinate prices. Cement was sold as high as $8 a barrel in New York at the peak of the manipulation of the market. It cost less than $3 a barrel to produce.'

"The facts are that in 1920, the average factory price per barrel was $2.01 (U. S. Geological Survey); the average cost of production per barrel was $2.02. During this year, the average price obtained by the cement manufacturers in the United States was $2.01 per barrel. During this same year, cement sold in the City of New York and elsewhere as high as $7 and $8 a barrel. The manufacturer obtained no benefit from these extortionate prices charged the consumer. He was powerless to prevent it. He delivered his cement under contracts to said dealers at the average price of $2.01 a barrel, and these dealers brought the Industry into disrepute by charging outrageous prices to the consumer.

"The World concludes:

'Government statistics of the Department of Commerce show that for the year 1919, the cement manufacturers, on an enormous capitalization representing the inflation of the war period, earned nearly 18% after deducting all costs, including taxes.'

"I do not know what records of the Department of Commerce The World is quoting, but the fact is that in 1919, the 19 eastern companies which were indicted had invested capital of $72,332,151.97. On this, they earned, minus taxes, $5,382,414.26,—a profit of 7.4%. It is not at all likely that the profits of the Industry in 1919 were higher than the average profit of the 19 companies above referred to."

Compressed Air Tools and Machinery

The Sullivan Machinery Co., 418 Gas Bldg., Chicago, Ill., have issued several new bulletins relative to products of their make as follows: 70-X, a compressed air spader or pneumatic clay digging tool; 77-D, portable air compressors of three distinct types; 79-C, Ironclad coal cutters for room and pillar and longwall mining; 79-D, coal cutters, Class CE-7 for room and pillar mines; 79-E, longwall Ironclads; 79-F, motors, driving gear, cutters and feed for coal cutters. All of these bulletins are clearly printed and finely illustrated, and are punched for binding.

Toluca—Deyo Company Have Their New Concrete Products Factory in Operation

The outstanding feature that struck a representative of CEMENT AND ENGINEERING NEWS who recently visited the new plant of the Toluca-Deyo Company, was the complete arrangement of every step of the process to eliminate waste of effort, time and material and get maximum production with the least amount of labor. They are manufacturing concrete drain tile, corn crib staves, concrete posts, silos, culverts and blocks.

The ground chosen for its site is an ideal one, and comprises six and a half acres—an area that will give the concern unlimited storing capacity for its finished product. Search where you will, it would be difficult to find a site more suited to the needs of the firm or one easier of access. Convenient to the town and the public highways in all directions, there are added railroad facilities that give outlet by two trunk lines to any section of the market. An agreement has been reached by the company with the Santa Fe and Alton whereby the Santa Fe can load cars and route them over the C. & A. without the usual formality and rep tape such methods usually entail.

The switch installed from the Santa Fe main line runs the entire width of the plant and passes over a large hopper equipped with an elevator to hoist sand and gravel to the two silo tanks, which are 14 feet in diameter and 30 feet high. Each tank has a capacity of four carloads of sand or gravel, as the case may be. The cement house is within five feet of the switch and so conveniently has everything been designed that waste time is practically eliminated and maximum capacity is possible with minimum of labor and equipment.

Provision has been made so that later on the switch can be extended to the limits of the tract to permit of loading cars from the stored product and thus eliminate the waste entailed from many handlings and removings.

At the west end is the work room and boiler room. The use of the boiler permits of curing of the product in the cold season with as great facility as in the warm. In this room the bending and reinforcing is done.

Adjoining is the curing room, which is 11 feet 6 inches wide and 80 feet long, with a semi-circular ceiling. Along the sides are steampipes, fitted with pep cocks at stated intervals to create a steam vapor. The semi-circular ceiling prevents vapor from accumulating in spots and resulting drops of water thus forming falling on the green product and ruining it. Instead the water will follow the curve of the ceiling and run down the walls.

From the curing room the CEMENT AND ENGINEERING NEWS representative journeyed to the cement room. Here he found everything in place and about ready for a tryout.

From the silo openings runs an inclined track on which is a bucket that operates on it to carry the raw materials from the tanks to the mixer, which is located inside on a platform, where the bucket automatically dumps itself. A well is located on the ground floor, with a pipe leading to a water tank alongside the mixer. The water tank can be so regulated as to permit automatically just the proper amount of water to enter the mixer needed for the product under manufacture, and no more. Thus the possibility of too much water ruining a mixing is avoided without loss of time and labor.

The mixing process over, the liquid mass is poured into a small hopper operating on a track, and is thus conveyed to the molding machine and dumped.

On the ground floor is a Dunn automatic tile machine No. 2 for producing drain tile from 4 to 16 inches in size. The capacity of this machine is 6,000 four-inch tile every nine hours. With it can also be manufactured three different sizes of building tile—4x12, 6x12 and 8x12 inches. This product is exceptionally well adapted for any kind of building purposes, and can be sold to the consumer for a considerably lower price than brick. Compared to the latter, experience has proven that it is as much superior in quality as it is lower in price.

The automatic molder produces concrete blocks eight inches square and sixteen inches long, its capacity being 1,000 blocks a day.

The Deyo culvert will be made in 11 different sizes, ranging from 12x12 to 48x48 inches.

The fence posts to be manufactured will be 7 feet long and 4½ inches through at the bottom, tapering to 3½ inches at the top. This post will have 4¼ inch reinforcing bars, which will be held securely in position by three clamps placed at the bottom, center and top, the bars and clamps being riveted together. This post is produced on a vibrating machine that enables the Toluca Devo Co. to get 21½ lbs. more of concrete into its composition than any other similar post on the market today. It is fully protected by patent secured by Mr. Deyo, as is also a concrete corn crib stave which will be placed on the market in the near future, and for which an exceptionally large demand is predicted owing to its adaptability for the use intended.

Another product that is planned to make in large quantities as soon as its manufacture can be reached is a silo stave, the features claimed for which are its lasting qualities and reasonable price.

The patents for these products, which were taken out by Mr. Deyo, have been transferred by him to the Toluca Deyo Co., which will control them during their life of 17 years.

We-Fu-Go System of Softening and Repairing Water for Quarry Boilers

Feed water from the usual sources of supply generally contains lime and magnesia, together with other substances in solution. Water supplies at stone quarries and cement mills are in almost every case much more highly charged with lime and magnesia than in other localities, and as a consequence of the larger amount of these impurities the accumulation of scale in the steam boilers is more rapid than where water supplies containing a lesser amount of lime and magnesia are available.

The accumulation of impurities of all kinds in the water in the boilers cannot be avoided; consequently the more work or steam that is required of the boilers, the greater is the amount of the impurities contained in the water in the boilers, and from these impurities there follows the deposition of scale. In many cases, in addition to scale, there is a corrosive action tending to destroy the tubes and shell. The failure of boiler tubes by blisters and blowouts is in practically all cases chargeable to the insulating effect of scale or a combination of scale and oil.

We-Fu-Go System Manufactured By Wm. B. Scaife & Sons Co., Oakmont, Pa.

A two-tank We-Fu-Go System in which measured quantities of water are treated to neutralize acids, soften the water, remove all iron, and to filter practically clear. The softened and purified water by the soap test is between zero and 1° hardness.

This design provides for a purified water storage basin in the base of the foundation, and the walls above ground line house the pumps, filters, piping and mechanical equipment, and provide storage space for chemicals. The design gives a complete self-contained water softening and filtering system. It meets every requirement for accurate softening and perfect clarification of water for industrial and domestic uses.

The various sources from which feed water is obtained and the wide differences in the quantities and kinds of impurities carried by it in suspension and in solution make it impossible to purify it adequately to prevent mud or scale from accumulating in the boilers by the application of any simple expedient.

Water from any usable source at atmospheric temperature or at the temperature of condenser discharge can be economically softened so that the purified water becomes a standard product with a uniform degree of softening and with complete absence of suspended matter and corrosive substances. The use of such a softened and purified boiler feed eliminates scale and corrosion and brings under control the operation of the steam boilers so that a high rate of evaporation can be secured without trouble from priming and foaming.

The softened and standardized water will show a complete removal of all suspended matter, oil, grease, iron, free carbonic acid and bicarbonates; a complete removal of all substances causing permanent hardness, and a removal of the substances causing temporary hardness to less than their corresponding solubilities in boiling distilled water. This standardized, softened water in the boiler produces a whitewash coating that protects the boiler surface and minimizes the danger of corrosion by oxygen. Such a softened and standardized water is obtainable with the We-Fu-Go system, which consists essentially of one or more reaction-settling tanks, equipped with mechanical stirring devices operated with power; a reagent or chemical mixing tank with a mechanical stirring device with means for introducing the reagents into the reaction tank and an efficient gravity filter. This system is manufactured by the Wm. B. Scaife &.Sons Co., Oakmont, Pa.

In this system, water of any temperature, in measured quantities, is treated with accurately weighed quantities of reagents applied separately. The reaction-settling tanks are filled alternately and while one tank is being filled, treated and settled, the other tank is supplying treated and settled water through the filter into the clear well. When starting to fill a reaction-settling tank, the stirring device is put in action and the first reagent is introduced. As soon as the tank is full, other reagents are introduced in sequence and the stirring continued for 15 minutes. After the filling and stirring period at least 2½ hours are allowed for reaction and settling before beginning to draw out the water.

Multiple equipments combine in a single outfit means for measuring CO_2 from 2, 3, 4, 5 or 6 boilers independently and simultaneously.

The recorder operates on the hydrostatic principle, by which all springs, levers and joint movements are avoided. It makes a continuous (not intermittent) record of the per cent CO_2 furnishing an autographic history of the operation of each furnace for every second of the day, showing when fires receive attention; when and how often furnace doors are opened, or how often stoker speed and fuel bed thickness are changed; fires broken and cleaner; effects of changes in damper regulation and methods of firing. Thus the real facts are recorded and the fireman gets a square deal.

The combined storage of water in the reaction-settling tanks and in the purified water basin or clear well insures a constant supply of water for varying rates of use without affecting the softening and purifying process.

In this system, accuracy of treatment is maintained by simple tests, and uniform purification of the water is obtained regardless of variations in the quantity of suspended matter, or the amount of soluble impurities in the raw water, and also regardless of variations in the rate at which the purified water is used.

For small capacities, a one-tank system is available, in which the required amount of water is produced by the treatment of one to three tanks per day.

We-Fu-Go System (One Tank) Suitable For small Capacities Ranging From 3,000 Gallons Per Hour Upward.

One or two tanks of water per day to be treated and the maximum capacity from such an installation is obtained by treating three tanks of water per 24 hours. This is an ideal system for accurately softening and filtering water for all uses.

The capacity of a two-tank system ranges from 2000 gals. per hour to 40,000 gals. per hour. Any two-tank system can be doubled in capacity by the installation of a third reaction-settling tank, and by doubling the filter capacity. The illustrations show a one-tank system and a compact arrangement of a two-tank system, having foundations designed so as to house the filter and operating mechanism, and provide storage space for reagents. That portion of the foundation that is below ground level is utilized for a clear well.

The value of softening and purifying water to a definite standard for boiler feed becomes apparent after only a casual survey of the expense and waste that is traceable to the impurities in the water as it comes from natural sources.

The removal of the scale forming and corroding impurities in the feed water is the rational procedure for economy in steam production and boiler maintenance.

Excavating Sand

Sauerman Bros., 1139 Monadnock Bldg., Chicago, have published an 18-page illustrated pamphlet on handling sand and gravel with dragline cableway excavators which dig, elevate, convey and dump material without the use of intermediate machinery. The scraper buckets are made in six sizes, from one-third to 2 cu. yds., and the maximum economical cable span is 800 ft. Photographs and text cover a wide variety of installations of this type.

Makes Concrete Alkali Proof

By B. F. ERDAHL.*

I have read the article in the June 1922 issue of Cement & Engineering News by Mr. S. H. McCroy, chief of Drainage Investigations, Bureau of Public Road, entitled "The Effect of Alkali upon Concrete" with much interest. Perhaps Mr. McCroy will be interested in a product we manufacture "Alkagel A" for making concrete proof against alkali.

Alkagel A is the trade name for colloidal gel which has been perfected by a distinguished chemist after experiment and research during the past 5 years.

This material is a glue-like, water-soluble colloid whose base resists the action of alkali and the complete compound possesses the rare property of becoming insoluble when dry. Alkagel A is thoroughly covered by patents in the United States and abroad.

All concrete is made up with water as a necessary indgredient. The mixture sets the action of water into a rigid system filled with thousands of microscopic capillaries or pores as the excess water evaporates. These pores do not close up. If they did, there would be a considerable shrinkage but none occurs. On account of the existence of these pores, concrete which is exposed to the action of alkali water is gradually broken down by the formation within the pores of salt crystals which expand as they form thus forcing apart the particles of cement which bind the aggregate together.

In order to make concrete proof against alkali, it was necessary to develop an insoluble compound derived from gelling-colloid which would form a colloidal film within the concrete capillaries. It was primarily necessary to find as a base, a gelling-colloid which would resist alkali and to so combine this material that it was water soluble, but would become insoluble both in water and alkali-water when dry. Alkagel A is the perfect material.

Alkagel A is a glue-like and water soluble so that it is readily combined in the mixing water for concrete. It improves the concrete for placing in forms or for manufacture of concrete drain tile on packerhead machines, as the resulting concrete has a gummy quality. This quality also brings about a greater density in the cured product. A large number of tests have proven conclusively that its use also produces greater strength in the concrete.

Alkagel A makes concrete alkali proof, for the reason that because of the insoluble film, the alkali water cannot penetrate the concrete and destroy it by production of salt crystals. It also acts as a negative catalyst preventing the intermediate chemical reactions whose end-products bring about the disintegrating effect.

Alkagel A is infallible as a means to make concrete immune to attacks by alkali in soils or waters. Alkagel concrete has been subjected to the most severe tests and shows no deterioration after immersion for two years in an alkali solution of 13,000 parts-per-million sulphate concentration. This concrete increased in tensile strength 100 pounds per square inch over concrete made from the same materials but without Alkagel A, which was immersed for the same time in soft water.

Should Mr. McCroy have an opportunity and would care to make field tests with Alkagel we should be glad to furnish you with samples against your report on the outcome.

*American Algin Products Co., 5806 Wadena St., West Duluth, Minn.

Valley Silo Company Develops New Type of Concrete Barn

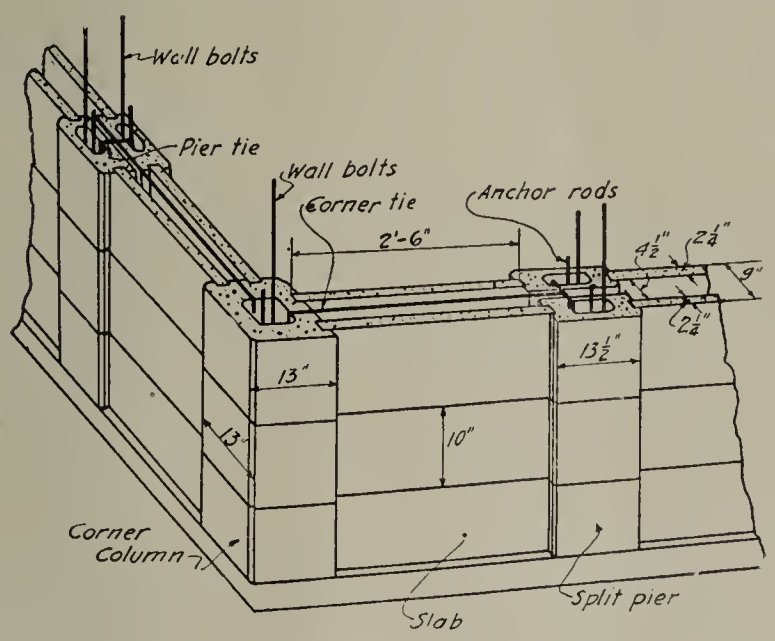
By M. J. BAKER
Valley Silo Co., Fargo, N. Dak.

In 1918 we built our first concrete stave barn in this locality. Since then fifty have been built or sold on the record of the first barn, which we consider ample proof that our barns are making good in this severe climate.

It has been our endeavor from the outset to perfect a barn that would insure warmth and dryness in addition to utmost structural stability. Appearance has not been overlooked either, and our barns are continually the subject of much favorable comment in this respect.

The Valley Silo Company built their first concrete stave barn in 1918. Since then thirty have been built or sold on the record of the first.

The building units used in the construction of the walls are concrete slabs or staves 2¼ inches thick, 10 inches wide and 30 inches long. These staves are now all being made by the wetcast method and are steam cured. By careful selection of aggregates and observing reasonable precautions throughout the various steps, in the manufacture of the staves, we are

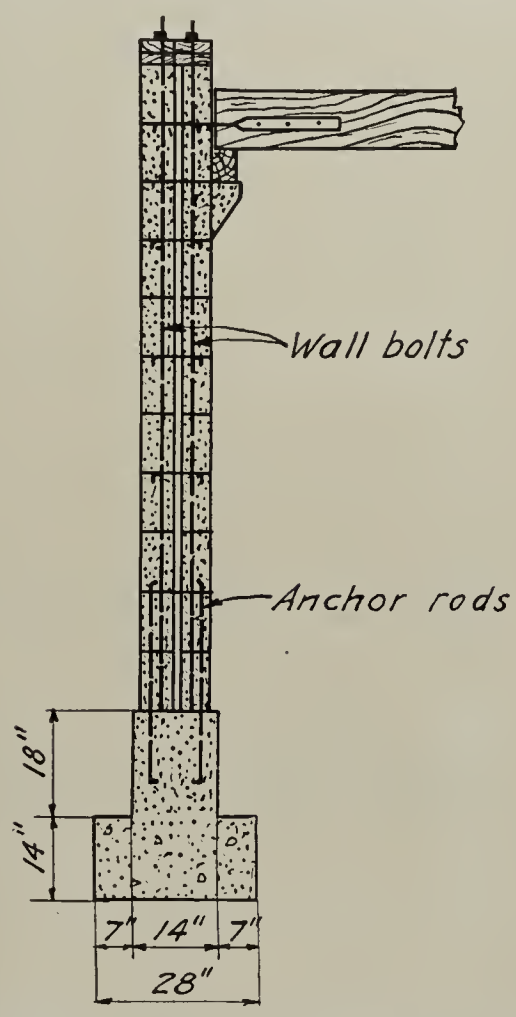


This drawing shows the details of the piers and double walls. When the walls are built the openings in the piers are filled with cement grout reinforced with 9/16-inch wall bolts.

able to turn out a dependable product—one that is hard, clean and of a strictly uniform quality.

With these units we build a pair of narrow walls having a continuous air space between. The units are held in place by precast piers at 3-foot 6-inch intervals. The pier blocks are 5½ by 10 by 13½ inches and are provided with grooves on the sides into which the ends of the staves are fitted. Each pier is hollow from top to bottom to permit the placing of reinforcing steel. When the steel is in place the cavity is filled with cement grout. Corner units, lintels, window sills and other details are all cast to fit into the general scheme.

In building up the wall the horizontal joints are set in cement mortar. The vertical joints at the ends of



Cross-section of foundation and wall. Mr. Baker says the only criticism directed against the barn is that the walls are "Too strong."

the staves are not buttered, but are pointed after the wall is built. In case of frost movement the pointing may have to be renewed, but the wall does not crack.

The wall is attached to the foundation by anchor rods which are placed in the foundation at the time the concrete is deposited and so set that they will project up into the pier columns to the height of three courses of staves. When the wall is erected to the required height, 9/16-inch wall bolts reaching from the foundation to a point 6 inches above the wall are dropped into the hole of the pier columns. These holes are then filled with cement mortar, and the wall is thus reinforced from foundation to roof plate. The upper ends of the bolts are threaded so that 2 by 12-inch plates may be bolted to the wall.

The corners are made of hollow units that are finally filled solid. In addition to the reinforcing described for pier columns, the corners have horizontal ties at a sufficient number of points to prevent possible separation.

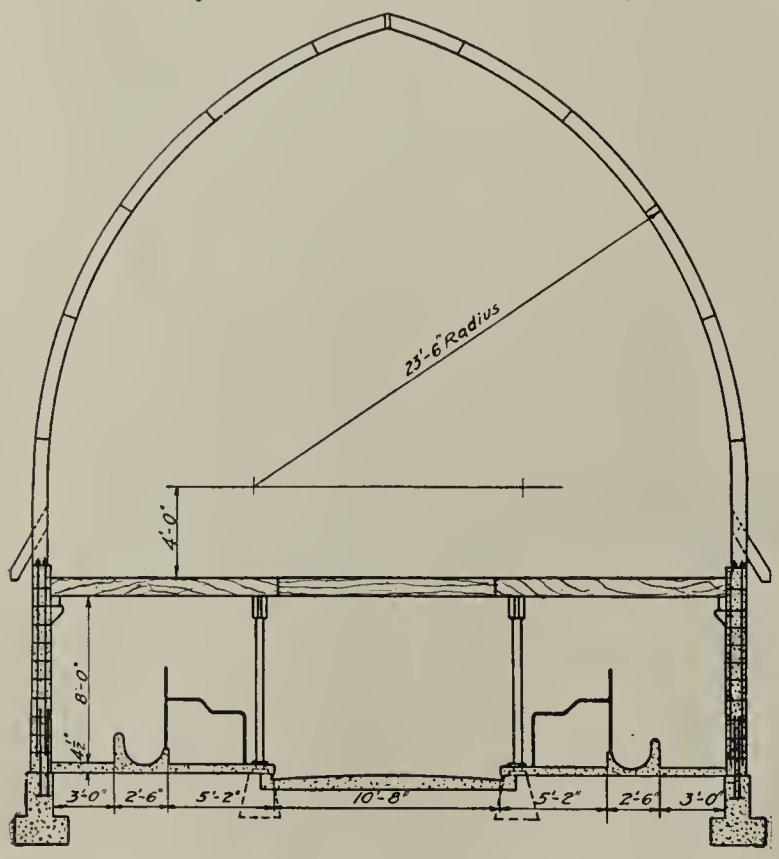
Some criticism has been directed against us because we make our walls so strong. From our experience with actual conditions surrounding the erecting of barns, we have observed that it is not the roof that

usually fails, but that it is the wall that gives way first. A roof is only as strong as its supporting walls. We had several barns in the region devastated by a hurricane in June, 1920, and none of them were injured. That may be just chance—but anyway the barns are still there.

The joists of the hayloft floor are supported on 4 by 6-inch timbers which rest on special girder piers set into the pier columns at proper intervals. Joists and timbers are rigidly bolted to the wall piers.

The photographs and drawings here shown are of the barn built for C. H. Hodgson, Gardner, North Dakota. This makes a very satisfactory barn with plenty of hay room.

A striking example of our concrete stave barn is the one recently built for E. D. Grant, Glyndon, Minn.



Cross-section of Valley Silo Co. Concrete Stave Barn. Notice the unusual amount of room in the hay loft.

His barn is 58 feet wide, 121 feet long and 12 feet 6 inches to the plate, and is covered with a gambrel roof. The cattle floor is a standard type of concrete construction. The hayloft floor is of reinforced concrete, beam and slab type. The construction work was done by a local builder but under the supervision of one of our own engineers.

As previously stated, we have centered our efforts on the development of a type of wall that will be dry, warm, fireproof and permanent. We can truthfully say that we now have perfected our concrete stave barns to a point that they will not frost on the inside, will not crack or crumble and will resist fire.

We regard the satisfaction of our customers who own the barns already built and the inquiry and demand for new barns of the same type as the best evidence that we have succeeded in our efforts.

Washes and Classifies Sand

Allen Cone Co., El Paso, Tex., has issued a catalog describing the Allen sand tank it manufactures. This booklet which is called bulletin No. 23, will prove highly instructive to all concrete workers. It will be sent free of charge to any one making a request to the company. The Allen sand tank is a machine for making high grade concrete sand and other building sands. It can be used, either by itself, or in combination with other machines made by the Allen Cone Co., for making special sands, or sands which are required to meet definite specifications. This machine not only washes the sand but it classifiees it as well. Classification or size of the product may be varied at will by the operator. The Allen sand tank is substantially made of No. 10 and 3/16-in. steel plate. All the points subjected to excessive wear are protected by bar iron or angle iron, or they are made of full weight castings. If the machine is properly cared for and given an occasional coat of paint it will prove very durable. Complete information on the important subject of washing and grading sand for concrete mixtures may be obtained from the company.

Dust Collecting System in Kosmos Cement Plant

A dust collecting system which practically eliminates chances of fire has been installed in the coal mill department of the Kosmos Portland Cement Co., Kosmosdale, Ky. This installation also reclaims the dust that heretofore was going to waste and thus effects a considerable saving. This equipment was worked out very simply by using the existing kiln blower fan as a means of suction. Four small pipe lines were extended to reach to the several corners of the building and feed into the main header.

The dust collecting system worked very satisfactorily reclaiming the dust that is necessarily free in the atmosphere of the building when coal is dried and ground to a very fine dust. The coal mill which this dust collecting system serves, is 200 ft. long with a wing 18 ft. wide. The coal dust is sucked into the 50″ Sturtevant fan and blown directly with the supply air into the kiln. No other provision for the collection of dust was necessary.

A 20″ galvanized iron pipe was connected to the fan as the main header. In order to pass through a wall at a given point and to reach a height of 15 ft. at a given place, it was necessary to connect the pipe to the fan at an angle of about 15°. The pipe then passes over a cooler and into the coal mill building at approximately 40 ft. distant. In this building the line runs the entire length where it is supported by the building wall. All outside supporting is done by wire cables attached to convenient fixtures.

To the main pipe line in the coal mill building are connected four six inch lines leading to four points requiring dust collection. Namely, the elevator feeding the dryer, the elevator at dryer discharge, the screw conveyor leading from the grinding mill and the elevator in the wing of the building which carries the pulverized coal into the elevation of the kiln bin. Intake hoods were placed on all four lines and in each case these were especially designed for the particular position the intake occupies.

Long radius curves were used where curves in the pipes were necessary with a view to reducing friction to a minimum. With the exception of a bend in the line at the fan, the pipe was erected the entire length at a 15 ft. elevation. This elevation eliminated all unnecessary bends.

The dust collecting system was installed without loss of production. The erection work was carried on, however, only when the coal mill was not in operation when the kiln coal bins were filled up ahead so that the coal mill could be shut down for a time. Difficulty was met with owing to the fact that when coal is dry it gives off a sulphur gas which makes work in the area around the dryers almost impossible.

Iron and Steel and Their Application in the Cement Industry*

By W. R. Shimer
Sales Metallurgist.
Bethlehem Steel Co., Bethlehem, Pa.

It was my original intention to present a paper containing definite recommendations for the more important iron and steel parts used in machinery for the manufacture of cement. Upon going into this phase of the subject in detail, I find that, due to various local conditions, a steel which is satisfactory for a certain part at Cement Plant "A", may not be suitable for the same part at Cement Plant "B". This is due to various reasons such as difference in hardness of rock, type of machinery, condition of machinery, personnel of men operating the machinery, etc. I will, therefore, confine myself to more or less general remarks and attempt to show how to obtain steel which will best suit the purpose, and how to draw up specifications which will assure a satisfactory product.

The writer cannot claim to be familiar with the mechanical details of cement machinery, and is, therefore, not in a position to ascribe failures to faulty design, although from an examination of certain failed parts there is every indication that some of the failures can be attributed to error in design. For example, the writer had the opportunity to investigate the breakage of shafts in an electrically operated shovel. This shovel was operated in the same quarry with two steam shovels. No shafts were known to break in either of the steam shovels, while the shaft breakages in the electric shovel were quite frequent. The writer was called in on this matter after the cement plant had proven to the engineer who built the shovel that power was developed which stressed the shaft to a load twice that for which it was originally designed. In other words, when the electric shovel was attempting to dig out the side of a hill in one scoop, and since an electric motor will withstand a 100 per cent overload momentarily, the shafts were stressed to double the amount for which they were designed, and as this stress was a sudden one, the shafts naturally twisted off. I understand that when a steam shovel is over-stressed, it will stall; there are no sudden shocks, and consequently shaft failures are much less frequent in shovels of this type.

The shafts in the electric shovel could not be made larger without making very radical changes throughout the entire mechanism, and it was, therefore, necessary to use a special nickel chrome steel, heat treated to give more than twice the elastic limit of the original shafts, and at the same time, the elongation and the contraction of area had to be fairly high to insure sufficient ductility to withstand the usual shock and vibration.

The physical properties of the failed shafts showed approximately the following:

Tensile Strength	62,000
Elastic Limit	32,000
Elongation, per cent	35.5
Contr. of Area, per cent	61.07

The heat treated alloy steel shafts showed:

Tensile Strength	112,000
Elastic Limit	90,000
Elongation, per cent	22.5
Contr. of Area, per cent	64.0

These physical properties more than make up for the deficiency in the size of the shaft.

It might be of interest to mention in this connection that for quick repairs, cold drawn shafting was used for shafts in this shovel, and some broke in one week's time.

While on the subject of cold drawn steel, I might mention its properties and the object in using it. It is made by pickling all the scale from the hot rolled bar, which is then pulled through a die 1-32 to 1-16 inch less in diameter than the original bar. This produces a bar of accurate size, with a smooth, bright finish. The bar is reduced cold and while cold extends in length in proportion to the amount of reduction in cross section. Low carbon steel is cold drawn without annealing but the higher carbon and alloy steels are annealed first. The physical effect of this cold working is to raise the elastic limit, in the smaller diameters, up to approximately 90 per cent of the ultimate tensile strength, with a corresponding decrease in ductility. Prior to cold drawing, the elastic limit of the same steel aproximates 50 per cent of the tensile strength, with considerable ductility. I would not recommend that cold drawn steel be used for important structural parts which must withstand shock and vibration. It is an excellent steel for screw stock, bushings, sockets and parts of this nature which must be turned out cheaply by the thousands on automatics. It is satisfactory for line shafts and other parts of like nature which are not highly stressed. Some years ago an automobile company in an attempt to save money on lathe work, used for a time, a cold drawn alloy steel for axles. They were drawn to finished size, and all the machining that was required was to cut to length and mill the ends square. This proved to be expensive economy as these axles failed in many of the cars after short service, and replacements were made free of charge in order to satisfy the car owners. The replacing axles were made of a special heat treated alloy steel, and they returned to the practice of turning the bars on a lathe rather than to obtain the accurate size by cold drawing.

Cold drawn steel has its field, and I do not wish to be misunderstood in my remarks concerning it. It is, however, false economy to use it for highly stressed parts as there are so many steels which can be heat treated to stand up under severe service and which will far outlive cold drawn steel.

Many parts fail in cement machinery on account of not being heat treated, or having been improperly heat treated for the service to be performed. Many times steel of correct composition for a certain use fails in a very short time, because of improper heat treatment. When properly heat treated this same steel will give satisfactory service. As a concrete example of this, I will cite the case of an order we received some years ago for ten bars of nickel steel four inches in diameter. This order was received from a drop forge concern and from the composition of the steel ordered, it was inferred that the steel was to be cut up and forged into gear blanks, which were to be subsequently heat treated. This steel was, therefore shipped to the customer in its annealed condition, having been annealed for machinability. A short time

*Paper presented at annual meeting of the Portland Cement Association, Atlantic City, N. J.

later, we received a complaint, stating they had made piston rods from three of these bars and put them in drop forge hammers. One lasted 2½ hours and broke; another lasted 5½ hours, and the third lasted about 15 hours. They stated this so-called high grade nickel steel was inferior to brass and wrought iron. The remaining seven bars were returned and given a special heat treatment by quenching in oil, with subsequent annealing, and were returned to customer and were found to be entirely satisfactory. This is one of the many examples which could be cited to show that while steel properly heat treated is satisfactory for the service required, steel of the same heat but improperly heat treated is not satisfactory. I might mention that in order to obtain the best service from alloy steels, they must be heat treated, as it is not good economy to use them otherwise. When heat treated, they are far superior to ordinary steels.

Proper attention is not always given to steel castings, due in part perhaps to the users feeling that because the casting was made of steel instead of iron that it had all the strength that was required, with the result that no check was made as to the analysis of the steel, or to its annealing. This applies, of course, to commercial castings. There has come to my attention quite a few failures of machines where steel castings have been used. The machines in mind at the present time are large jaw crushers.

Up to a few years ago, the primary crusher was fitted with a jaw opening of about 24 by 36 inches but with the advent of steam shovels, it became necessary to increase the size of crushers with the result that these machines are now built with openings up to 5½ by 7 feet.

In the designing of these larger size crushers, the manufacturers went to the use of steel and made a great many of the crushers in sectional design, i. e., the side frames and end frames being separate castings, machined and held together by turned bolts.

Another design of crusher consists of a "semi-steel" frame reinforced with a cast steel band which is shrunk around the bottom of the frame and a cast steel band around the top. The design of this crusher is such that the steel bands take all of the crushing strain.

The failures of these steel crushers have been due partly to the fact that the analysis of the steel was incorrect, and partly to the fact that the castings had not been properly annealed, if annealed at all. In one of the large plants, not so long ago, there was broken in operation a crusher in which the frame was 20 feet long and the cross section of the steel about 6 inches by 5½ feet.

The breakage of these casting showed that the steel was very coarse grained and that it had not been properly annealed, with the result that original strains were still in the castings. Had these castings been properly annealed, there is no question but that the machine would have stood up and that the breakage would not have occurred. The repairs to this particular machine will cost the operating company many thousands of dollars, as the machine will first have to be banded together to permit it to continue to operate, and later the side frames entirely replaced with new castings.

There has also been brought to my attention the failure of a crusher which was reinforced with a heavy steel band. This band was of oval shape and had a wall cross section of 5 by 24 inches. It broke at three points almost simultaneously, and the nature of the breaks indicated brittleness. Upon investigation, it was found that the casting was too high in carbon and further that it had not been properly annealed. The microscope showed a structure of steel in the same condition as when cast, and if it had been annealed at all, it only went through the motions of this operation, as there was no indication whatever of annealing from the examination of the casting itself.

Foundries or forge plants will often, in order to fill up their shop, take on work for which they are neither trained nor equipped to handle. Sometimes, by good fortune, their product stands up in service, but in many cases like the one just cited, it did not, and caused considerable loss to the cement plant and considerable embarrassment to the crusher manufacturer, who was not directly to blame. Manufacturers of machinery should, however, investigate the foundry prior to placing orders for castings, to determine if they are competent to make such castings, and the castings should be inspected to be sure they are of the right composition and properly annealed.

The practice generally followed is to specify certain physical properties in accordance with the specifications of the American Society for Testing Materials. These tests being taken from coupons which are attached to the casting, and heat treated with the casting. Test coupons are integral with the casting. They should not be broken from the casting until it has been heat treated. If, by accident, the coupons should be broken off prior to annealing, they should not be heat treated separately but should be charged in the same annealing furnace at the same time with the casting in order that it receive identical heat treatment with same. This is necessary in order to be assured that the physical results obtained from the coupon represent the physical properties of the casting itself.

Failures such as those just briefly cited might mislead prospective purchasers into believing the machinery itself was at fault. In cases of this kind, no reflection can be cast upon the make or design, because the failures are directly due to the fact that the makers of the castings did not furnish a good product. It is always unwise to place an order for a special part to the lowest or any bidder, without first having been satisfied as to his ability to furnish a satisfactory product.

I believe I am safe in stating that the average mechanical engineer knows steel only in a general way, as he has neither the time nor the opportunity to keep up to date with the rapid advances made in this art. Even we, who are working on this subject all the time, find it difficult to keep pace. An engineer will design a part and figure on a certain factor of safety, for example of 5 to 1, when he expects to encounter shocks, etc. With this factor of safety, he may require steel of say 110,000 lb. elastic limit, which predetermines an ultimate strength of approximately 140,000 lb., but loses sight of the fact that to meet this high elastic limit, the elongation and contraction will be relatively low, and he will have a steel lacking in ductility, so that the real factor of safety is actually much lower. For such a highly stressed part, he would have a more satisfactory product if he used a factor of safety of 4 to 1, and asked for a steel having, say 90,000 lb. elastic limit, with proportionately lower tensile strength, since he would have a corresponding increase in ductility, thereby enabling the part to withstand shock and vibration.

One big problem in some cement plants is to obtain satisfactory shafts for gyratory crushers. Low to high carbon steels and alloy steels heat treated for high tensile strength and elastic limit have been used, but certain plants still have more breakages than they should. I have been investigating this subject with a view to developing a satisfactory steel and a heat

treatment for this purpose. In general, I find the tensile properties need not be high, but the important properties are elongation and contraction of area. The shafts which on the average stand up longest in service are those with greatest ductility.

I have interviewed a number of cement plant operators who use the gyratory crushers and find such shaft failures are peculiar to certain plants, while others rarely if ever have this trouble. The plants which have no failures attribute their success to the fact that they make a special effort to keep dipper teeth, sledge hammers, and other iron and steel parts from going through the crusher. The penalty to employes allowing such parts to go through is dismissal. I am inclined to believe that this is one of the major reasons for shaft breakages as this would explain why the harder shafts are more susceptible to failure than the softer and more ductile ones. When a large piece of steel passes through a crusher, something has to give, as the crusher itself cannot stall. If the liner plates do not break, the shaft must distort. A hard shaft will act as a spring, but the excessive strain which has been put on some points, usually on the outside surface, will produce a nick of perhaps microscopic size, which we might call an incipient break, and during continued service, it grows larger, finally resulting in the fatigue break, which these shafts manifest on fracture. The softer steel shafts will bend and at times even take a permanent set, but there is no doubt but that the increased ductility accounts for their being longer lived. When a plant has an unusual number of breakages of this nature, and if it is certain no foreign material has gone through the crusher, an investigation should be made by a competent party, as such a condition can generally be corrected either by a change of steel or by special heat treatment.

I understand some gyratory crushers are being redesigned in order to permit shortening of these shafts, and that these shorter shafts are reducing the breakages to a considerable extent.

I can easily imagine how the cement plant engineer, or the engineer building machinery, who might interview six to a dozen representatives from as many different steel concerns, could become confused when attempting to boil down the diversified information received. The same thing would happen if the writer were in the market for cement, and with his limited knowledge of this product, would have difficulty deciding whose cement was best after interviewing representatives from as many cement companies. I would probably purchase from the lowest bidder, and no doubt obtain just what I paid for, namely, an inferior product. The enthusiastic steel salesman may elaborate on the wonderful physical properties of a special alloy steel, representing results obtained from a small test bar, and leave the cement engineer to believe that these results can be obtained in a 15 or 20-inch diameter forging. Were the engineer to attempt to purchase a forging requiring such high properties, the reliable steel manufacturer would try to discourage such requirements, but the engineer might find some one hard up for work who would try to furnish it, and the chances for its giving satisfactory service would be very slight.

I believe I am safe in stating that cement machinery must stand as much or more abuse than machinery for most other industries, on account of the abrasive materials handled, and the considerable amount of dirt and dust always found in the cement plant, which becomes imbedded in bearings. Some parts must stand both wear and shock, and some must stand either shock alone or wear alone. In the case of parts which must stand both wear and shock, a happy combination can be obtained by means of case hardening the outside surface, which will resist wear, retaining a strong and tough core to resist shock. In the case of a part which is not subjected to shock, this can be made of a steel which can be hardened throughout. In the case of a part which must stand severe shocks and vibrations, certain steels can be specifically heat treated to stand up for this service. It is my impression that certain parts, such as gudgeons, liner plates for tube mills and crushers, are expected to wear out in a certain length of time, and replacing material is ordered without investigating the possibility of obtaining a material which will give double the service or better. It seems that breakages and excessive wear are accepted as a matter of course by many cement plants. There are manganese steel castings made which stand up best under certain conditions at one plant, while some other special steel casting or forging will give better service at another plant. Each plant has its own individual problems which can be worked out by the proper co-operation with reliable steel manufacturers.

Take pinions, for example. Cast iron pinions are cheapest if the first cost is considered only. Occasionally a cast iron pinion makes an exceptional record, but how often is a cast iron pinion obtained which wears out or breaks in a short time, usually breaking before being worn out, and where the cost of labor and curtailment of production on account of repairs would make the ultimate cost considerably higher than if good special steel, heat treated pinions had been purchased in the first place.

Satisfactory iron or steel for almost any purpose can be obtained if the manufacturer is acquainted with full details concerning requirements, and if he is paid the price. No matter what the commodity is, we generally receive the quality we pay for. When a cement company wishes a forging and is only willing to pay a certain limited price per pound it will receive a forging which is worth the price paid for it and no more, since in order to make a forging at such a figure the steel manufacturer will have to select his steel accordingly, and perhaps at this price he cannot afford to heat treat it. If a forging is required, payment of a fair price to a reliable manufacturer will secure a special steel properly selected, and will insure careful heat treatment for the service required. Though such a forging might cost three times as much per pound, it would probably last more than three times as long; but if it outlives the lower priced forging only 2½ times, it would be cheaper in the end, on account of continued operation during this extended period and saving on cost of taking down and reassembling.

In the case of the steel casting failures on the jaw crushers, mentioned earlier in this paper, these castings would no doubt have been cheap at 50 cents a pound if they had not broken.

The cement engineer should work closely with the steel plant metallurgist and the cement plant purchasing agent should work closely with the cement engineer. In cases where the purchasing agent does not co-operate with the engineer, he will buy steel other than that specified by the engineer if he can obtain a reduction in price. This reduction in price may be quite costly, due to curtailment of production and cost of repairs on account of break downs. If there are parts which break or wear out too soon, the cement plant should look for something to give better service and go to a reliable source of supply, state what is wanted, with a complete history of the average service obtained from past material, and details of its iron or

steel composition. With such information, the metallurgist should be able to recommend iron or steel which would be more satisfactory, and while many times he may recommend a steel which will cost somewhat more, sometimes he finds a high priced steel being used where a much cheaper steel would have given as good or better service.

Before closing, I wish to emphasize the importance of co-operation between the cement engineer or the engineer building cement machinery, and the steel plant metallurgist. In our corporation, we find it valuable for our plant engineers and engineers who are designing or building machinery to keep in constant touch with our metallurgical departments. When they design a machine to perform a certain operation, they first consult the metallurgists to determine which steel will best stand up in service, and the physical properties which can be obtained from this steel, and they then design their machinery accordingly. In some plants the designing engineer will design his machinery independent of metallurgical advice and make some parts so light and at the same time requiring extremely high physical properties, that he works a hardship on the metallurgical and heat treating departments which must resort to the use of high priced alloy steels, which may be very sensitive to heat treatment, and which may crack and distort during the drastic heat treatments needed to obtain the extremely high physical properties. This results in high shop losses and often in the installation of defective parts, causing failure in service. Where there is close co-operation between the engineer and metallurgist, such a condition is not likely to occur, and although the machinery may be somewhat heavier, it will be more efficient. The metallurgist finds it necessary many times to consult with the engineer before recommending steels for certain parts in order to become acquainted with the exact details of the duty which the particular parts are to perform. We find in our corporation that neither can get along without the other, and certainly this same condition must hold true with the cement industry or any other industry using iron or steel.

Austin Steam Rollers

Austin Manufacturing Company, Wrigley Bldg., Chicago, has just issued a very complete catalog of the famous Austin Motor and Steam Rollers, known as Catalog F. The book is profusely illustrated and shows not only the Austin line of rollers but many interesting views of the rollers in action on important work in the United States and overseas. To those who do not know the extent to which Austin machines have penetrated the uttermost parts of the earth these pictures will be a surprise and a revelation of what American machinery is doing in foreign lands.

Steam Turbine

Allis-Chalmers Mfg. Company, Milwaukee, has published a 54-page illustrated booklet in which steam turbine and generator units are describel and illustrated. These are of the non-condensing and condensing type with pressure operated by pass valve. They are adapted for sugar mills, refineries, saw mills, power and manufacturing plants, etc. The equipment is described in detail and the illustrations include numerous line drawings.

Severe Transmission Tests Show Lion Paw Belt to Be a Product of Unusual Merit

A conviction that the quality and character of fabric belting could be improved and a belief that the constant necessity of dressing belts to obtain the proper friction and to preserve their life could be avoided, were instrumental in leading H. L. Buckner, president of the Buckner Process Co., and for many years a specialist on the proper application of lubricants, to invent and manufacture Lion Paw belting.

Lion Paw is a solid interwoven fabric belt having permanent internal lubrication, which prevents deterioration of the fabric and gives greater pliability. To resist moist or acid conditions, oil or great wear from crushed rock or hot cement, Lion Paw is also treated with a patented filler coating that prepares it for these uses, without diminishing its pliability or life.

In order to determine the characteristics of Lion Paw belting, R. D. Skinner & Co., Inc., 150 Nassau street, New York, distributor of this belting had comparative tests performed at the New York Testing Laboratories with five other types of belting.

In all cases the best 4-inch belting of the following types were used: Medium double leather, 4-ply rubber, double (approximately 6-ply) camel's hair, 6-ply balata, 6-ply medium solid-woven and 6-ply Lion Paw (standard coated). The belts were all 27 ft. long and jointed with Crescent belt fasteners.

Comparative driving efficiency tests were made under various conditions; first, under normal working conditions; second, under extreme atmospheric conditions produced by immersing the belts in water several hours; and third, all belts were saturated with a medium-heavy lubricating oil. The results showed that in the first two tests Lion Paw had the greatest horsepower at slip-off, leather next and the solid-woven third. In the oil-saturation test, leather stood highest with Lion Paw second and solid-woven and rubber tied for third. A test of the relative coefficients of friction showed Lion Paw to have the highest by a considerable margin in Tests 1 and 2.

To obtain comparative strength of the several kinds of belting, tensile strength tests were made on a sample cut from each. The solid-woven produced the greatest ultimate strength per pound per square inch and the least amount of elongation before failure, while Lion Paw was a close second.

It is said that Lion Paw's greater effective pull before excessive slip is due in part to its greater flexibility, which tends greatly to increase the arc of contact.

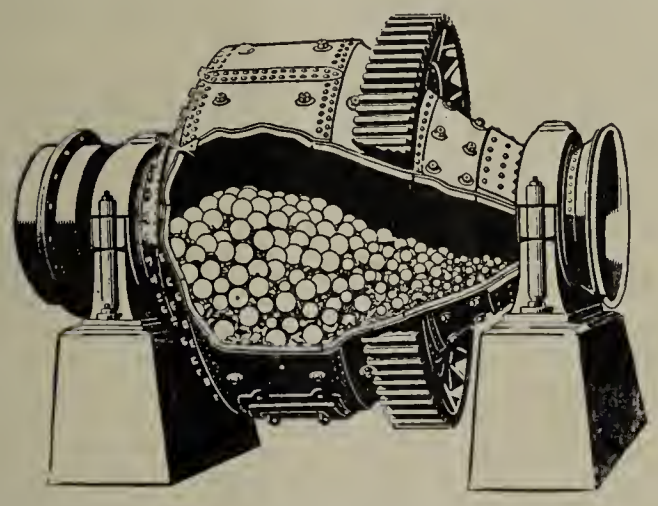
Lion Paw belting has been in practical operation for more than 3 years, particularly in New England, where it is in use in many large textile and paper mills. As a conveyor, it has achieved unusual results, particularly in one of the large cement plants, where the company installed a belt 680 feet in length and 20 ins. wide to carry hot cement. The belt is still in first-class condition after over 6 months' service, while in the same time and on the same conveyor two belts of other construction are cracking and beginning to deteriorate. The initial cost of Lion Paw is about one-half that of leather, and maintenance costs, as one might imagine are small, due largely to the fact that the belt is so constructed as to have internal lubrication.

Hardinge Company Publishes A New Catalog On Pulverized Fuels

A bulletin entitled Pulverized Fuels has just been published by the Hardinge Co. This bulletin is known as its No. 9 catalog.

The adoption of the Hardinge mill for pulverized fuels is comparatively recent according to its own statement, as follows:

"The Hardinge conical mill, although only recently applied to this field, has been fully demonstrated as a most satisfactory unit for pulverizing solid fuels. The results obtained are a continuation of the remarkable



Showing Balls Segregated During the Operation of the Hardinge Conical Mill.

record of the Hardinge mill in the mining and industrial grinding fields, as evidenced by the fact that over 70,000,000 tons of friable materials are being ground per year in Hardinge mills alone."

This bulletin is divided into three main sections, viz., the application of pulverized fuel to various burning problems, the principle of operation of the Hardinge mill, and a discussion of the application of the Hardinge system for pulverizing fuels.

Under the heading of Pulverized Fuels, three principals causes are mentioned why the advance of this class of fuel has been so rapid in the last few years. These reasons are:

a—The increased efficiency of combustion.

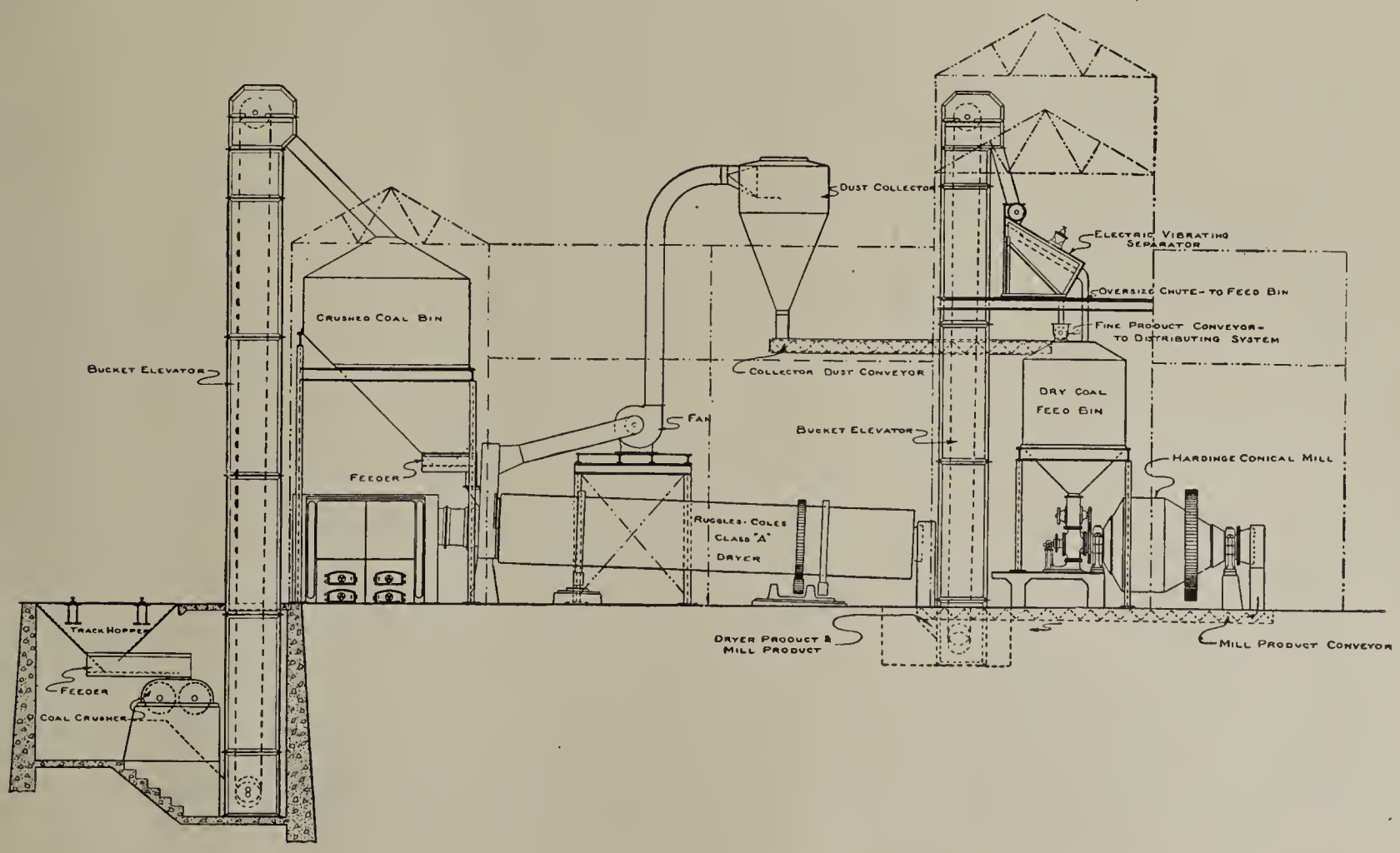
b—The utilization of fuels whic hwould otherwise be wasted or be very inefficiently burned.

c—Flexibility of operation and ease in handling making it possible to control the burning within a wide range on short notice.

In the general discussion of pulverized fuel where the Hardinge system is used, emphasis is laid upon the point of "sparking" during the burning process. The company emphasizes the point that when coarse oversize of from 65 to 150 mesh, depending upon the character of fuel, is eliminated, "sparking" ceases, and when this oversize is eliminated by a satisfactory means, it is not necessary to grind to a degree of fineness which was at one time thought necessary.

Under the subject "The Hardinge Mill," the general principle of grinding is discussed, with special reference to stage reduction, elimination of the fine particles as soon as produced, and the proportioning of energy to the work required. The different types of Hardinge mills and the details of their construction are also discussed in this section, and special reference is made of the advantages of the conical mill when used for pulverized fuels of widely different character.

Under "Pulverized Fuel Installations," a complete pulverized fuel plant is outlined, which includes the feeding of the coal from the track hopper to the crushers, dryer, mill, separator and distribution system. There are also taken up different arrangements of the mill and separator which would be used according to the special requirements. In addition, there is given a table showing the general dimensions of the different sizes of Hardinge mills so that it is possible to make a rough estimate of the floor space required for each unit.



News of the Cement Mills

L. L. Woodward, Chief chemist of the Oregon Portland Cement Co. died suddenly at his home in Oswego, Oregon.

The Wolverine Portland Cement Co., Coldwater, Mich., statement for the past 12 months shows surplus of $27,362.23, with total assets of $1,093,026.72.

Permanent assets were $801,135.86 and current assets $150,579.62. Cash assets were given as $113,-438.17. Accounts payable amounted to $30,217.67 and bills payable $12,759.08. Reserves were $20,176.87.

During the yeaer only one mill was operate at Coldwater, but the officers state that they are looking for a successful season in 1922.

The mill of the Superior Portland Cement Co. Concrete, Wash. is a wet process. The raw material is first taken by a Bradley-Hercules mill, from whence it goes to one 7 by 9-ft. ball mill and one 87 Prelininator and then into six preliminary 6 by 22-ft. tube mills, which does the fine grinding. The product, slurry, has had the water added during the process.

They have three kilns, 7½ by 7 by 135-ft. one 8 by 192-ft. and one 9 by 8 by 192-ft. made by Allis-Chalmers Mfg. Co. These kilns operate with coal, it requiring 175 lbs. per bbl. Have a coal pulverizing plant. In the finished grinding they operate a Bradley-Hercules mill and seven 6 by 22-ft. tube mills.

The Colorado Portland Cement Co. E. J. Strock, Superintendent, Portland, Colo. have made considerable improvement in the plant the last year. In the raw mill department they substituted hammer mills in place of kominuters for preliminary grinding. In the drying end they substituted stokers instead of producer and in the finish end by installing another kominuter to take the work off the tubes. There was also some increase in general efficiency of labor. They operate a dry plant with limestone and shale. Maximum depth of shale is 68 ft. and of limestone 60 feet.

First steps to increase the production of cement in the Northwest have been taken by the Universal Portland Cement company in beginning work on an addition to its plant at Duluth, Minn., which increases its capacity 40 per cent, from 1,500,000 barrels a year. The new capacity will be equivalent to 8,-100,000 sacks a year.

The demand for cement in the Northwest this year has been so heavy as to greatly tax the present capacity of the plant here. A great increase in the use of cement is seen in the orders of small dealers through the Northwest.

The good roads movement is greatly augmenting the demand for cement, as many communities in the state are constructing or preparing for the construction of hard surface highways.

Glens Falls Portland Cement Co., Glens Falls, N. Y., is enlarging its capacity by installing more kilns, waste heat boilers, erecting reinforced concrete buildings for the storage of stone and clinker and installing a new system for cooling clinker and also a new crushing plant. F. L. Smidth & Co., New York, are in charge of the work.

The Monolith Portland Cement Co., Monolith, Calif. reports great progress in sales of its plastic waterproof cement. Where formerly it was used for outside plastering mostly, it is now being used extensively in foundation work, sidewalks, driveways, reservoirs, floors, and in fact is rapidly replacing the ordinary Portland cement.

While the cost is somewhat more than the ordinary Portland, it is found that on account of the high quality of this product the price is not in any way prohibitive, and architects and engineers, specify this product very extensively in all classes of construction work.

Recent tests have shown that this product has very unique and unusual qualities. For instance, its adhesion to steel reinforcing is 50 per cent greater than ordinary Portland cement. Microscopic examinations recently made by Smith, Emery and Company of Los Angeles show that the crystallization of concrete where the Monolith plastic waterproof cement is used is distinctly different than that of the ordinary cement. To quote from their report:

"A low refracting substance occurs in plates with strong cleavage and straight extinction. There is about twice the bulk of this material in the plastic that there is in the regular Portland; not only is the quantity in excess but the plates are much larger and better developed in the plastic. It is pushed into cavities and clings to and surrounds the unaltered grains. For this reason the plastic is much more compact."

Manufacture of cement at the plant of the Ash Grove Lime & Cement Co., Chanute, Kans., has been suspended temporarily while the change is made to the new power system. This cost close to half a million dollars and has just been completed after having been in course of construction nearly a year.

The change will take about three weeks, it is estimated. Grinding will probably be resumed before the middle of the month, however. The company anticipated the cessation of operation by maintaining continuous operation through the winter, accumulating a large surplus of finished product and clinker. This will enable it to take care of its trade.

Hudson Valley Portland Cement Corp., Alsen, N. Y., purchased the properties of the Alsen Cement Co. of America, Inc., and has engaged in extensive alterations and additions, including the installation of modern grinding machinery and other equipment in quarry, raw grinding and finish grinding departments. The process will be changed from a dry process to wet process. Raw materials are quite variable and the wet process will insure an absolute uniform product and closer chemical control. The engineering work is being carried out by Ellis Soper. When this work is completed the company will have one of the most modern mills in the Hudson valley district. The first unit of 1500 bbls. is expected to go into operation the first of April and the second unit will go into commission the latter part of this month. A third unit will be installed in the middle of the summer. Waste heat boilers will be installed and the ecompany will begin operations with practically a year's contract. The product will be marketed under the brand of "Storm King."

Index
Vol. 34, January—December, 1922

	No.	Page
PORTLAND CEMENT		
Alumina cement—its development, use and manufacture ..	10	18
Cement specifications for Foreign countries	1	17
Cement Association, bases membership on quality of product..	1	22
Cost of producing cement	6	16
Conveyor shows low cost in handling bag cement	8	26
Cement sack losses	11	16
Detecting flash setting cements.	3	28
European cement market.....	12	22
Freight rates on cement	3	35
Fredonia cement co. operates unique reclaiming equipment..	10	21
Interpreting the chemical analysis of Portland cement....	6	21
New slow setting cement	1	34
Opening statement in Trial of cement manufacturers	5	17
Portland and other cements in 1921	11	15
Portland cement specifications..	6	35
Prices of Portland cement in 1921	3	29
Possibilities in fused cement...	1	31
Quick setting cement	3	17
Quality control in cement manufacture	8	27
Quick hardening cement.....	8	33
Twenty year tests of cement and mortar materials	4	28
What makes cement quick setting	1	31
Why prices of cement are uniform	5	30
What is Portland Cement	9	16
Why one standard for Portland Cement	9	29
DESCRIPTION OF PLANTS		
Building the new Pyramid plant	6	30
Cement mill of Hawkeye Portland Cement	6	19
Continental Portland Cement Co. increases capacity	3	18
Dust collecting system in Kosmos cement plant	12	28
Modern plant of manufacturing finished lime	3	30
New cement mill for Michigan.	9	31
Oklahoma Portland Cement Co. increasing capacity	8	17
San Antonio Cement Co.....	1	19
GENERAL CEMENT MILL NEWS		
General Cement Mill News.....	1	36-37
General Cement Mill News.....	2	36-37
General Cement Mill News.....	3	37
General Cement Mill News.....	4	36
General Cement Mill News.....	5	36
General Cement Mill News.....	6	36
General Cement Mill News.....	7	36
General Cement Mill News.....	8	36
General Cement Mill News.....	9	36
General Cement Mill News.....	10	36
General Cement Mill News.....	11	36
General Cement Mill News.....	12	34
NEWS OF THE CONCRETE PRODUCT FACTORIES		
News of the Concrete Products Factories	1	38
News of the Concrete Products Factories	2	38
News of the Concrete Products Factories	4	38
News of the Concrete Products Factories	5	38
News of the Concrete Products Factories	6	38
News of the Concrete Products Factories	7	38
News of the Concrete Products Factories	8	38
News of the Concrete Products Factories	9	38
News of the Concrete Products Factories	10	38
News of the Concrete Products Factories	11	38
News of the Concrete Products Factories	12	38
EDITORIALS		
A national organization to improve uses of concrete.....	9	15
Amount of water used in making concrete	11	15
Concrete institute convention...	1	15
Concrete walls	4	15
Cost accounting	7	17
Cement-A civilizing force	8	15
Do the American people like to be buncoed	6	16
Excessive special tax	5	15
Good roads movement.....	3	16
How the Cement industry increased efficiency of product.	12	15
Investors find safety in manufacturing plants	5	16
Increasing factory efficiency....	8	15
Modern business methods for concrete product manufacturers	6	15
Memory	9	16
Noted engineer and educator dead	1	16
Research in concrete and concrete materials	3	15
The metric system	1	17
The 1923 convention	10	15
What Cement is doing to reduce fire hazards	10	15
SPECIAL ARTICLES		
Atmospheric conditions hasten initial set of cement. By C. L. Jenkins	5	33
Aggregate strength No. measure of concrete strength. By F. E. Giesecke	11	19
Concrete hauled from central mixing plant. By Eugene R. Hoffman	9	25
Concrete pipe line augments Kansas City water supply. By Frank E. Miller	10	16
Deflection of reinforced concrete beams of rectangular cross section. By Frank P. McKibben.	3	20
Experiences with thin concrete slabs. By John V. Schaefer..	4	29
Effect of alkali upon concrete. By S. H. McCroy.....	6	17
Finds solution to its road problems in concrete. By J. C. McElherne	10	25
Iron and steel in the cement industry. By W. R. Shinier..	12	29
Nothing to sell but an ideal. By H. Colin Campbell	10	31
Quick hardening cement developed by the French. By Edwin C. Eckel	1	30
Road guard rail timbers mounted on concrete pipe. By A. D. Butler	2	35
Suggestions for care and operation of wire rope. By James T. Howe	1	21
Solving the problems of the Cement industry. By F. W. Kelley	7	15
Two recent methods for proportioning concrete. By H. H. Scofield	2	28
The manufacture of concrete pipes by the Hume centrifugal process. By W. Wolstenholme	2	33
To avoid variable concrete due to sand wetness. By R. L. Bertin	11	21
SAND, GRAVEL, CRUSHED STONE and GYPSUM NEWS		
A new sand and gravel washing plant well planned and carefully executed	1	28
A Minnesota gravel plant.....	3	33
A fatal quarry accident from falling rock	4	20
Accidents at stone quarries ...	12	16
Account of the early history of quarrying	12	21
Big quarry blast	7	20
Core drilling	2	32
Clear Lake Sand & Gravel Co..	3	17
Crushing plant engineering ...	5	25
Cost, data on quarry blasting...	8	19
Crushing and screening plant of Birmingham Slag Co.....	9	18
Crushed Stone Company, utilizes screenings.....	10	20
Dust collecting systems for crushing plants	10	28
Explosives and blasting	11	26
Explosives for stone quarries...	9	30
Electrical operation of River Rock Gravel Co.	5	19
Gravel plant at Oxford, Mich....	4	22
Growth of a great company....	7	22
Gravel company makes concrete brick	7	26
Glass sand company finds concrete bins economical.....	9	33
Handling materials successfully in cramped quarters	3	26
Hill of gravel 125 ft. high.....	5	30
Increasing the gravel output in a Michigan pit	7	21
Know your sand	6	34
Limestone quarries	3	35
Methods of crushing stone in Texas	4	17
Operating a Pennsylvania quarry on three levels	8	20
Preparing Iowa sand and gravel for market	1	24
Plant of River Rock & Gravel Co.	2	21
Preparing sand and gravel for the Ohio contractors	7	27
Reducing explosive costs.....	6	20
Reducing blasting costs	5	18
Sand company manufactures concrete products	8	20
Slag company manufactures concrete brick	7	18
Selection of screening machinery	6	29
Suggestions for installation and operation of dredging pumps.	10	26
Three hundred thouhand tons of trap rock loosened	2	22
The production of sand for glass making	11	18
CONCRETE AND CONCRETE CONSTRUCTION		
A study of the effect of moisture content	3	28
A busy concrete block factory..	7	33
A well organized concrete plant.	8	30
Areaways increases efficiency of buildings	12	20
An experiment in decoration of concrete surfaces	12	18
Aggregates supplied by hydraulic plant	11	33

Index (Continued)

	No.	Page
Acid proofing and hardening of concrete	11	20
Batch boxes transferred from trucks to cars	9	19
Blocks vs. tile	5	31
Base and scratch coats that can be nailed on	9	24
Concrete fuel oil tanks at Panama Canal	9	31
Cement paint for stucco	9	33
Construction details of Montgomery Ward buildings	10	34
Concrete drain tile in alkaline soil	11	17
Concrete pipe molds	11	31
Concrete burial vault industry	1	32
Concrete proportioning tests	1	25
Colored mortar	2	17
Costly railroad re-location	2	23
Colorado Springs and the Interurban Railway Co. paving job	3	22
Concrete piers for suporting lumber piles	3	23
Concrete stock watering tanks	4	21
Cardinal point of stucco	4	22
Cement block men organize	4	34
Concrete road specifications	5	28
Concrete blocks and tile	6	16
Concrete road construction in Indiana	6	25
Concrete brick	6	31
Concrete farm buildings	6	32
Concrete and lumber computing scale	7	19
Concrete floor tile	7	22
Concrete road construction in Illinois	7	29
Concrete pipe	8	16
Cement blocks improve	8	16
Concrete fire proof dwelling	8	19
Concrete road construction in Illinois	8	20
Concrete piling that can be sunk without a pile driver	8	22
Contractor makes use of available equipment	9	23
Concrete pipe piles in Tasmania	9	24
Discuss concrete products and specifications at convention	3	24
Drain tile specifications approved	8	19
Designs features of concrete arch bridge at Winnipeg	9	20
Easily handled concrete	8	25
Effect of sea water on concrete	1	27
Effect of colorings on concrete strength determined by test	2	16
Effervescence on face brick	2	18
Effect of cal in Portland Cement	2	31
Fence posts offer business opportunity	12	20
Fundamentals of waterproofing	7	25
German colorings for cement	11	17
Granite face texture brick	7	35
Highway experts pass on final design of ideal section	1	18
Hollow wall concrete construction	1	23
Hydrated lime in cement blocks	1	32
Hydrated lime in Railroad shop buildings	9	32
Hollow walls of concrete	11	24
Hydrated lime in concrete pipe	4	27
Hydrated lime for concrete	4	34
House walls	5	32
Hardening concrete floors	6	28
Hydrated lime in concrete	6	29
Hydrated lime in Belle Isle bridge approach	7	23
How to make concrete patches	7	28
Interchangeable coal and sand silos	7	19
Impohtance of construction industry	4	19
Integral waterproofing of concrete	11	15
Limestone crusher dust and poor concrete	3	27
Large hollow concrete blocks form dock wall	9	27
Large reinforced concrete covered reservoir	2	19
Long span concrete roof arches for Chicago garage	8	32
Moore unit system of house construction	1	31
Modern concrete proportioning	9	17
Makers of concrete products organize new association	7	26
New laboratory abrasion test for concrete	4	23
One course vs. Two course	2	16
Pebble dashed farm houses	12	16
Prevention of culvert undermining	12	17
Permanent materials in building	7	28
Precast stone trim produced for Baltimore refinery	8	23
Practical concrete roofing tile	8	33
Quick work on a winter job	10	22
Report of committee on concrete block houses	9	30
Stucco church of double wall construction	9	29
Sage foundation building concrete houses	11	23
Sand lime brick manufacture in England	7	22
Strength tests on premixed concrete	7	31
Small mixer on big job	8	26
Surface treatment of concrete	2	15
Surfacing concrete blocks	2	15
Smooth watertight concrete	2	20
Stucco questions and answers	2	25
Sand lime brick	3	34
Stucco and civic pride	3	36
Super Cement an improved Portland Cement	3	36
Stucco	4	15
Successful stucco work	6	24
Strength of concrete at increasing intervals	6	27
Two interesting concrete bridges in Oregon	4	25
The thermal conductivity and diffusivity of concrete	1	18
Test of a concrete mixer	1	35
The concrete pipe business and its posibilities	2	17
The recent failure of the roof of the Knickerbocker Theatre	3	16
Tests of concrete	7	33
To test sands for concrete	9	30
Toluca Deyo Co., new concrete products factory	12	24
Unwashed and ungraded river gravel makes good concrete	3	27
Use of concrete stone is growing	8	16
Valley Silo Co. develops new concrete barn	12	27
Vacuum grave vaults	11	25
Virgin growth and second growth timber	1	16
Will make artificial stone	6	15
Warehouse built of concrete	1	33
Wrecking concrete	1	34
Workability in concrete	11	29
Waterpoof cement paint	11	18
Winter months offer bargain counter to builder	12	15
Engineering accomplishments	9	33
Freight rate	4	35
John B. Foote	11	21
Large trucks show lower transport costs	7	20
Lead too pure for cathedra roofing	7	33
Largest single shipment of blast hole drills	4	34
Metric system	3	27
National forestry policy committee	4	16
Nine million dollars paid to injured workmen	7	24
Non freezing explosives	10	17
Perfect package month	1	16
Potential water power	1	16
Reward of the stayer	1	20
Rusted sheet metal work	9	28
Right refractory in the right place	11	35
Repaired by welding	3	33
Sound proof partitions	7	33
Safety devices would eliminate elevator accidents	1	17
Ten commandments of belt conservation	1	20
Tearing down a brick smoke stack	6	24
Test of heat conductivity of walls	7	23
Wire rope problems settled	4	16
What motor trucks do and what they cost	7	31

MISCELLANEOUS

	No.	Page
A ditch in a hurry	1	23
Awarded Wason medal in research	5	16
Boiler setting permanent and of low cost	4	33
Business hunting	5	16
Council for cement association, corrects mistatement	12	23
Comparison of operation of shovels	11	22
Ditch blasting	2	24
Education and fuel conservation	9	26

NEW BOOKS

	No.	Page
American homes	3	25
Annual proceedings, Vol. 21	4	33
Business analysis of U. S., by counties	10	29
Business side of contracting	7	17
Bungalow homes	5	33
Belt conveyors	1	35
Cements, limes and plasters	11	29
Concrete products	11	34
Concrete stone manufacture	5	18
Concrete houses—how they were built	2	30
Elementary hydraulics	11	35
Elementary concrete construction	1	35
For the practical concrete man	1	33
Modern building superintendence	1	35
Manufacture of Portland Cement	5	27
New cement manufacturers directory	1	27
New directory and market data book	4	24
Reinforced concrete construction	6	23

DESCRIPTION OF MACHINERY

	No.	Page
Anchor one man brick machine	1	23
An economical crusher	3	36
Anchor stave tamper	4	16
Automatic motor starters	5	32
A crusher is no better than its lubricating system	8	24
A new crawling tread crane	8	34
A complete pulverizing unit	8	35
Automatic block machine	10	29
Agricultural limestone machinery	11	30
Big blast hole drills	1	33
Bucket elevator improvement	7	34
Bradley hercules mills	10	33
Compact air hoist	2	18
Concrete pipe machine	3	26
Corn crib block machine	4	32
Car unloaders	5	35
Caterpillars for railroad type shovels	6	31
Conical mill with improved trunions	7	20
Cast steel portable rock crushers	7	35
Dodge friction clutch	2	27
Dunn shovel mixer	5	31
Dryers for coal, sand, cement, etc	9	35
Electrically operated drill	1	27

1/3 more per dollar

Excerpt from a letter written by a large user of Dumorite for quarry operations

''A few months ago your representative requested us to advise you of the comparative results obtained by using your DUMORITE explosive in our quarry work. We have kept reasonably close record of powder used and work done during the past three months. We find that we have been getting the following results:

''First and mainly, we find that we have been blasting with the same tonnage of rock at a decreased powder cost of between 25 and 30%; also we find very little if any fumes in this powder, and had no freezing results when used in cold weather; in fact while heretofore we have bought our dynamite in one or two ton lots, after a few months' experience we gave an order for a carload of DUMORITE and have just received same--this being the first time we have ever bought dynamite in carloads.''

DUMORITE *Has Proved Itself*

DUMORITE, the new du Pont Dynamite, has passed the acid test of trade approval. Since its introduction to the quarrymen, it has saved its users thousands of dollars. The above opinion is representative of the many Dumorite users, who have found that this new explosive, which gives 1/3 more per dollar, has established new standards of explosive economy in quarry blasting.

If you are not using Dumorite, write our nearest branch office for further information.

E. I. du Pont de Nemours & Co., Inc.

Explosives Department

Wilmington, Delaware

Branch Offices:

Birmingham . Ala. Boston . . Mass. Buffalo . . N. Y. Chicago . . . Ill. Denver . . Colo. Duluth . . Minn. Huntington, W. Va. Kansas City . Mo. New York . N. Y. Pittsburgh . Pa.

Branch Offices:

Portland . . Ore. St. Louis . . Mo. Springfield . . Ill. San Francisco, Calif. Scranton . . Pa. Seattle . . Wash. Spokane, Wash.

Du Pont Products Exhibit, Atlantic City, N.J.

NON-HEADACHE DU PONT **NON-FREEZING**

DUMORITE

THE LATEST OF A COMPLETE LINE OF DU PONT EXPLOSIVES

News of the Concrete Products Factories

R. B. & W. H. Walters, Ora, Ind., started making concrete products, having bought a second hand outfit. Are interested in building block, chimney block, fence post and drain tile machines.

On a recent installation of 345 ft. of 10 in. by 20 in. Wendelken interlocking culvert at the plant of McPhee & McGinnity Co., in Denver, to carry a steam main and return line from the heating plant to the other building, it was possible to save considerable time and trouble by installing the bottom half of the conduit, placing the pipe, connecting up and testing the lines, placing the insulation and covering with top units. This construction may be opened without much inconvenience should trouble occur, the pipe line be repaired and the cover replaced.

This job was accomplished in very cold weather and in about the same time that would have been necessary to build forms for monolithic construction.

The special units for railroad culvert construction were developed to fill a demand. The construction combines the flat base, elimination of continuous vertical joints, the load distribution, and the rectangular cross-section common to monolithic construction with the comparative low cost, quick installation and centralization of labor incident to the use of the oval pipe culvert.

The Wendelken culvert is assembled from a series of interlocking precast concrete units reinforced laterally and longitudinally. The units are made in standard lengths of two feet with graded sizes of openings.

The new plant and gravel pits of the Colorado Concrete Mfg. Co., South Fountain Road, Colorado Springs, Colo., represents a $60,000 investment. E. C. Van Diest is president, and F. E. Bumstead, manager and secretary-treasurer.

The manufacture of their concrete pipe is an exceedingly interesting operation. The sand, and other materials, except the concrete, is secured from a hill which rises above the plant and has but to be conveyed by machinery to the Kent continuous mixer. There it is mixed automatically and when at the proper consistency is put through the Dunn machines which holds the pipe.

Inside of a mold, which stands on end, is dropped by a large machine a revolving steel cylinder. There is just sufficient room between the two for the wall of the pipe. There the concrete is poured and tamped down as it falls. The tamper is a part of the machine. The pressure forms the pipe, so that the section can be taken from the mold and carried away to dry.

The revolving steel core polishes the interior of the pipe, so that it presents a glossy and smooth surface when in finished form. This is very desirable.

These sections of concrete pipe are cemented together when laid. Thus a continuous strong, unleaky conduit, into which it is impossible for branches of trees to penetrate, is formed.

The fence posts, for use by farmers in building barbed wire fences, as well as for use elsewhere, are made much the same way, except that there is not the hollow center to be provided for in their construction. The building blocks will form another interesting product of the plant, and it is believed by the company that there will be as good demand for them locally as well as in many other communities as there is for the pipe and the posts.

"Gravity does our work," says C. J. Herzog of the Pittsburgh Cretestone Products Co., of Pittsburgh, Pa. "Our manufacturing cost is reduced because of the location of our plant on the side of a hill, which makes it possible to move all our materials by gravity."

There are three levels in the plant: upper level, where fine and coarse aggregates are stored in separate bins; middle level, where cement is stored and the mixing done, and the lower level, where the block are made. Aggregates are dumped from motor trucks directly into the storage bins. Cement in sacks is dumped into a chute and slides down to the middle level, close to the Kent continuous mixer. Coal is dumped into a chute which carries it to the lower level within shoveling distance of the boiler used for steam curing.

Aggregates move by gravity into the measuring boxes over the mixer. The mixer discharges into a hopper directly over the feeding device on the machine. Block are loaded on cars which run on industrial tracks close to the machine. From the machine through the curing tunnel to the far end of the storage yard the tracks have a uniform fall of ⅛ inch to the foot.

Mr. Herzog says: "You see we handle our materials as litile as possible and when we have to handle them we do it with the least amount of manual labor. In the future, instead of bringing in our raw materials by motor truck, we expect to use railroad cars which run on a level about eighty feet above the present storage bins. Track hoppers will be installed and aggregates, coal and cement will be chuted to the bins in the plant."

While it is not possible for all plants to locate on hillsides, it is possible for the majority of plant operators to make gravity do a large amount of work. By the use of bucket conveyors to elevate materials to overhead bins a products manufacturer can virtually create his own hillside and make use of gravity in his remaining operations in the plant.

Convenience, comfort and durability are combined in the substantial type of bench manufactured and distributed by the Art Concrete Works of Pasadena, Calif., and its licensees. The ends of the bench are of concrete strengthened with a specially designed reinforcing. Slots are provided for the insertion of the back and seat slats, which are made of California redwood, two inches thick, painted or varnished.

The benches are also made by Wilbert W. Haase of the American Vault Works, Forest Park, Illinois, and furnished free to the neighboring village of Oak Park by its local Rotary Club.

Mr. Haase recently received an order from the city of Toronto, Canada, for six hundred benches of this type, to be paid for out of a bequest of $10,000 made for this purpose by James Ryrie, a citizen of Toronto.

ON that date a Goodrich salesman came out of one of the largest corporations in the world with an order for a Goodrich "LONGLIFE" Conveyor Belt. It was a very small order—obviously a trial order. Compared with the mammoth belts at work in this company's eight great plants its size was most insignificant. To gain entry for others of its kin, this "LONGLIFE" Belt would have to show qualities of durability, economy and smooth, flexible running, superior to any other belt at work on idlers.

Did it? Judge from these facts: **Since March 4, 1911, this corporation has bought 42,422 feet of "LONGLIFE."**

That is typical of the impression "LONGLIFE" makes wherever installed.

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

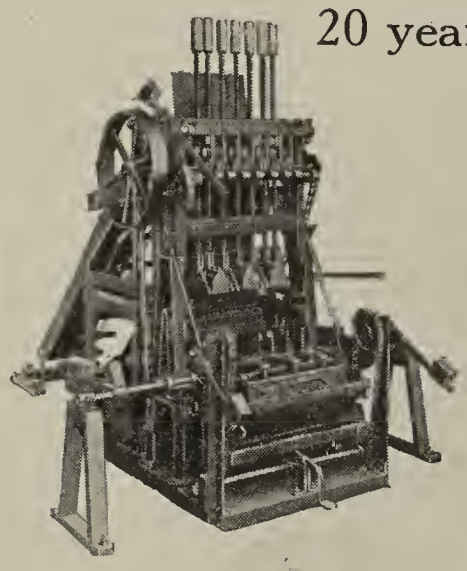
Goodrich

"LONGLIFE" *Conveyor Belts*

"BEST IN THE LONG RUN"

Your Satisfaction is Guaranteed

One of the most vital features of Ideal service is our pledge to please the user of our products. Our guarantee means that every Ideal product must be all that you have a right to expect of it or we make it right. Our reputation of more than 20 years of fair dealing is your protection.



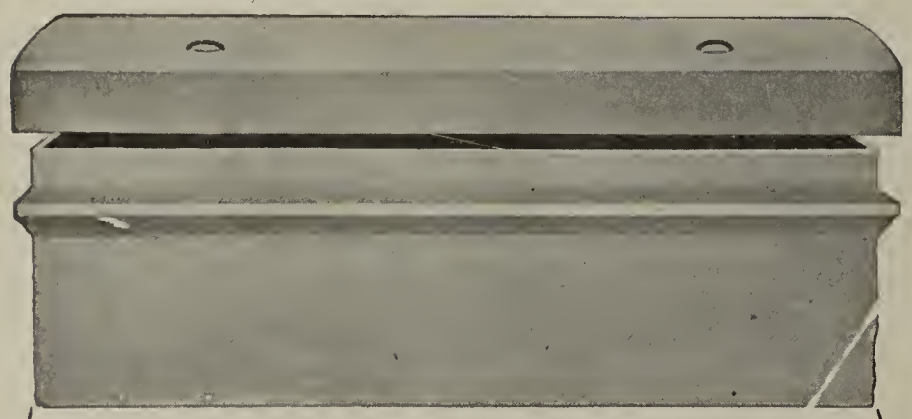
Ideal
TRADE MARK

Fully-Automatic Building Tile Machines

deliver three tile on a single pallet, with no stopping or delay for offbearing of tile. A perfected, absolutely reliable machine that will help your business grow.

The Ideal Concrete Machinery Co.

1338 Monmouth St. **Cincinnati, Ohio**



A clean-cut, graceful, strong, water proof burial vault that sells readily

DON'T SHUT DOWN YOUR PLANT THIS WINTER

Winter is the busy time for the progressive concrete vault maker and the Automatic Sealing Burial Vault is one of the most profitable products you can make—100% to 200%.

In fact, the products maker who goes into the vault business in earnest usually makes more money out of it than he does from all his other products put together.

Equip your plant for a vault business this winter. We'll help you sell the vaults. Write us for complete particulars.

AUTOMATIC SEALING VAULT CO.
216 E. River St. PERU, IND.

—money in vaults

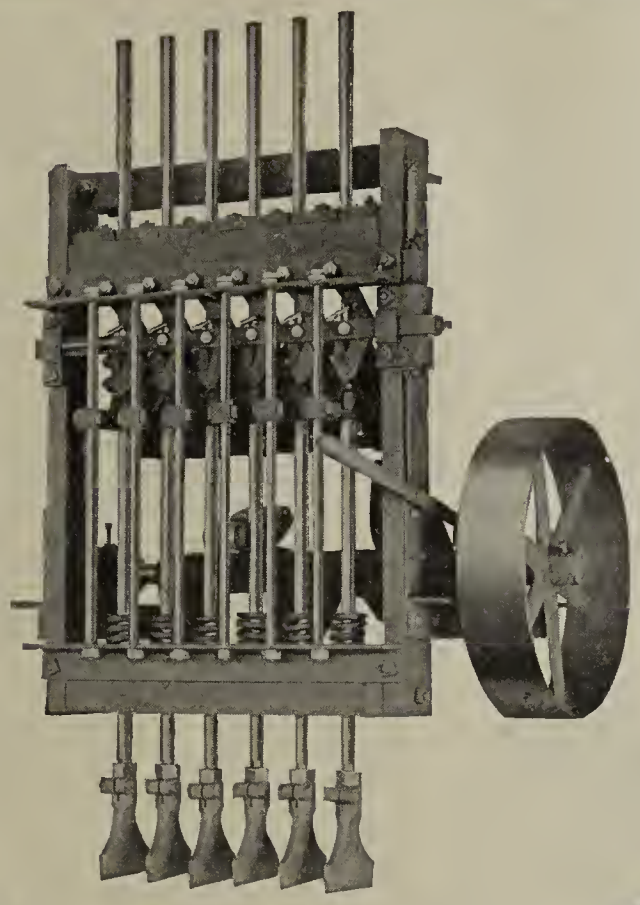
Kept Dry With Medusa Waterproofing

Basement walls and floors kept thoroughly dry from the day the job was completed over five years ago—Mt. Sinai Hospital, the most modern building of its kind in the city of Cleveland, stands as another splendid record to the credit of Medusa Waterproofing.

Protect **your** foundation walls and floors, too. You can buy Medusa Waterproofed Cements already mixed or obtain Medusa Waterproofing separately in paste or powder form for mixing on the job. Bulletins containing complete specifications, gladly sent at your request.

THE SANDUSKY CEMENT COMPANY
Dept. E. Cleveland, Ohio

MEDUSA
WATERPROOFING
for **CONCRETE**



WIDELY REGARDED AS "THE MOST EFFICIENT TAMPER MADE"

Proven Performance, Lowest First Cost, Lowest Operating Cost, Unequalled Service—these are the undeniable advantages which have given Kent dominance in the tamper field.

Easy running, low upkeep, operating economy, and long life are assured qualities in every Kent tamper. Kent engineers have had years of experience in designing concrete products machinery. Let us send you proofs of Kent superiority.

KENT CONTINUOUS MIXER
for CONCRETE PRODUCTS PLANTS

Is your plant equipped with modern machinery that saves labor, holds down your pay roll, and turns out large quantities of QUALITY products at a low cost? You have not the proper equipment if you are mixing concrete with a machine designed in fact for another trade.

The Kent is especially designed for the needs of concrete products plants. It is low in cost, continuous in action, easy to keep in repair and it has a good clean record of 15 years in the industry. The price will interest you—due to our special facilities and unusual manufacturing advantages. Write us for full particulars.

RED LINE PRODUCTS

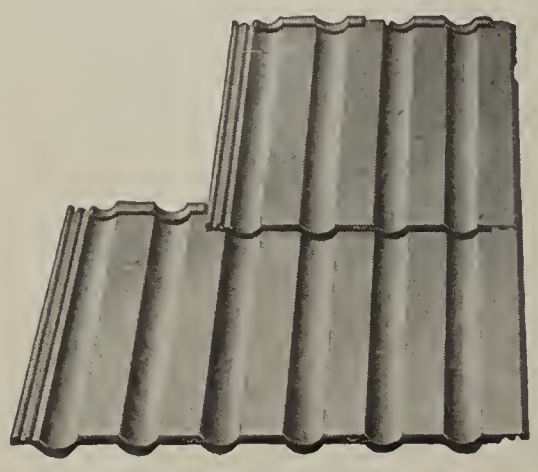
Automatic Tampers	Continuous Mixers
Block Machines	Batch Mixers
Block Cars	Elevating Devices
Lift Trucks	Electric Motors
Gravel Screens	Gas Engines

KENT MACHINE CO.

KENT, OHIO

CHICAGO OFFICE, 429 Monadnock Block

YOU OUGHT TO INVESTIGATE THE SUCCESSFUL



FRENCH TILE

developments we have made in the concrete roofing tile manufacture in the way of absolutely PERMANENT COLORING and unique STRENGTH OF THE TILE, performed with our new coloring method and a peculiar pattern of the underside of the tile—specially designed for giving the tile the GREATEST STRENGTH IN ITSELF and for the purpose of REINFORCING THE TILE IF DESIRED.

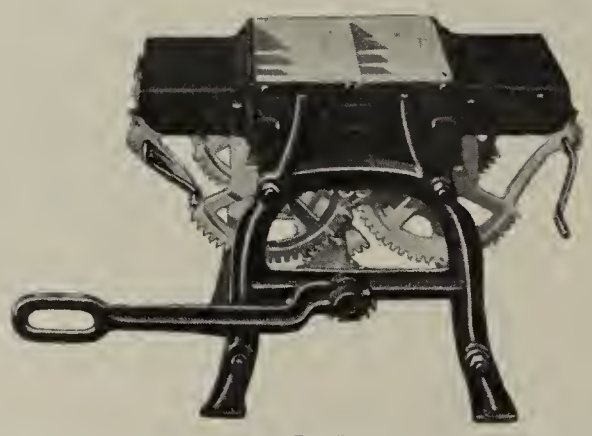
The service we give our customers is thorough and insures you of success when you are entering the concrete roof tile business—using our machines.

Write for the U. S. CHAMPION ROOF TILE BULLETIN

L. HANSEN CO.

3617 E. 23rd Street Kansas City, Mo.

SPANISH TILE



Double your daily output with

DOUBLE-SPEED

Brick and Block Machines

Now is the time to increase the capacity of your block plant—turn out the maximum number of wall feet per day, while the demand for building materials is at its highest.

Block Output

Our Double-Speed Block Machine makes in each operation: 2 hollow blocks, 2 silo blocks, 2 solid blocks, 2 slabs, 4 half blocks, 2 water table slabs, 2 return ends, 2 chimney blocks, or 2 porch pier blocks.

Brick Output

Double-Speed Brick Machine makes 16 brick at each operation, 8 brick being delivered at each side of the machine.

Double Speed Tamper

This power tamper gives our block machine a capacity of 1,500 blocks per day and speeds the brick machine up to 12,000 brick per day. Roller-cut-off removes surplus material from mold box and finishes the top of the product. The block and brick are tamped rapidly and vigorously, resulting in a dense, strong product. Machine consumes little power and is practically fool-proof.

Write for block and brick machinery catalog, Dept. A,

Wood Bros. Thresher Co. Des Moines, Ia.

THE HOBBS

The multiple oval cores of a Hobbs machine make the use of wet mix possible with no loss of time. The result is a hard, dense, waterproof block—plain for foundations and cover walls—faced for superstructure.

For Catalogs and Prices, write

The Anchor Concrete Machinery Co.

Adrian, Mich.

Rock Rapids, Iowa; Columbus, Ohio.

Makes 5,760 building blocks a day

The Debay Completely Automatic Block Machine is a piece of equipment that can turn a struggling block plant into a prosperous manufacturing enterprise.

It is the only concrete block molding machine in the world that has rotating mold members with stationary core bars.

Hand labor is reduced to the minimum.

Keep the material hopper full and the finished 8x8x16" blocks flow from the machine on an endless belt in an endless stream at the rate of 12 every minute, 720 an hour, 5,760 a day.

The product includes standard 8 x 8 x 16" back-up, corner and end blocks in a wide variety of faces.

See it in the movies!

You can see the machine operating in a plant at Springdale, Pa., or we will show moving pictures of its operation in any community where interest is manifested in the proposition.

Write for details.

Debay Research & Mfg. Co., Springdale, Pa.

He Said—

"Folks Won't Pay Any More For White Blocks Than For Gray"

—But They Did!

HE manufactures concrete blocks in a busy, prosperous community—just as you do. He is trying his level best to turn out good, uniform, dependable blocks—just as you are—and has gradually built up a good reputation for himself and his product.

But he *didn't* believe folks who bought concrete blocks for porch columns, pillars, aboveground foundation work, etc., cared anything about the color. "Blocks are blocks to *my* customers," he said.

So, one day the Medusa man went down to his place and painted the face of one of his blocks a pure, shining white with Medusa Cement Paint. Then he painted another a clear, pretty red and another a bright green—you know Medusa Cement Paint comes in several pleasing colors beside white. Then the Medusa man put these blocks out in front, set at a good angle to attract attention. And at the end he put a plain, common gray block just as it came out of the mold!

Well, pretty soon along came a building contractor with a bill of stuff for an estimate. "Gee!" he said, "where'd you get 'em? Just what I need for the foundations and porch columns of those bungalows we're putting up over in Brannon's Allotment. How much?"

You see, he thought they were some special composition! When he found they were just common blocks with two coats of Medusa Cement Paint, he was tickled all over; and you should have seen him grin when he found what a trifle the paint added to the cost of the job!

Did he buy? You bet he did, right then and there! Our block-manufacturer friend not only sold the Paint at a profit, but he cut competition clear out—because the contractor had planned to go to another block maker and get *his* price, too!

In about half an hour, an Architect drove by, and the "rainbow" stopped *him*. Happened that he had just gotten the commission to design a church, and while he had already decided to use Medusa White Cement cast-stone trim around windows, doors, and cornice, he was trying to figure some way to cut costs on the ground course and water-table.

Those pure white blocks gave him an idea; so he stopped his car, came in, asked a lot of questions, and drove away again.

A couple of weeks later, the concrete man found that his blocks had been specified; and when the job was let, the contractor came straight to him with the order.

Along that same afternoon, a woman came in with a complaint. That is, she came *intending* to make a complaint, but when she saw those blocks, she changed her mind. She had gotten some fern vases the year before (this concrete man makes garden furniture, too) and she was "peeved" because they had discolored a little in the weather.

But those clean, fresh-looking blocks out front gave her a new idea; so instead of reading our friend a lecture, she asked some questions and then hired him to send a man up and paint her vases with Medusa Cement Paint. A little later she ordered some new stuff, also painted white, and before the season was over, seven of her friends had ordered pieces for *their* gardens.

That was one busy season for Mr. Cement Block Man—and for the dealer who sold him his Medusa Cement, Medusa Waterproofing, and Medusa Cement Paint. But when he checked up at the end, he found he was away ahead of any year he had ever put in before; and better still, he found he had all the good trade of his neighborhood coming right to his door—some of it past the plants of other block-makers whom he used to consider competitors!

* * *

Medusa Cement Paint comes in dry powder—white and five pleasing colors—ready to use when mixed with water. Brush it on like any other paint. Two coats will give concrete a handsome, lasting finish, impervious to dampness; will beautify new concrete or freshen and renew old jobs.

It contains no oil whatever and will bond perfectly on any surface of cement, stone or brick.

You can finish your work in Medusa Cement Paint as you produce it, or furnish the Paint right along with the blocks to be applied after construction.

In any case, keep a few blocks finished in white and colors, out on display all the time. We'll gladly send sample for you to try. What color?

The Sandusky Cement Company, Department E. P., Cleveland, Ohio.

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete.

Several great states have so ruled.

American Steel & Wire Concrete Company's Reinforcements fulfills every engineering requirement.

Send for our book on road building.

Chicago
New York
Cleveland
Pittsburgh
Denver

CRUSH YOUR STONE and GRAVEL

The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No.* 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa,

VACUUM GRAVE VAULT MOLDS

make the money, latest in vault construction.

Every vault you make means a big profit, because of the simplicity with which they are manufactured and the freedom from extensive overhead expense.

Molds are all steel, adjustable to make vaults for any size casket, easily set up and quickly filled.

If you are capable of handling a business that promises rapid growth—you are the man we want—we can put you in position to make money.

Write today—let us send you the details.

GEO. ZIEGELE

215 BROADWAY AVE. PEORIA, ILL.

BELTING

"V-B" Balata
"AMPERE" (Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples

VICTOR BALATA & TEXTILE BELTING CO.

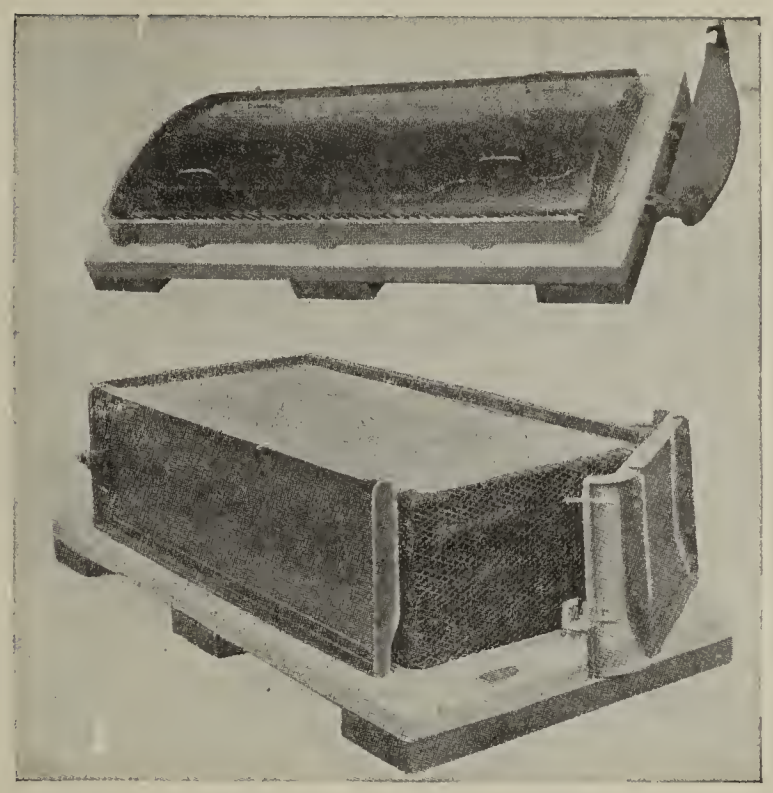
Factory: Easton, Pa. Main Office: 38 Murray St., New York
Stores: 167 N. Market St., Chicago, and 87 High St., Boston

CONVEYOR BELTS A SPECIALTY

The Sure Route to Big Profits

The real BIG money in the concrete business goes to the men who use **Utility Concrete** Equipment. It speeds up the work, cuts down costs and makes better products. Find out why by writing concrete equipment headquarters for complete catalog and prices.

Concrete Equipment Co.
540 Ottawa Street
Holland, Mich.



Get Into the Burial Vault Business

In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault, for which there is a national demand. No royalties; never a failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

CHICAGO CEMENT BURIAL VAULT AND CASKET COMPANY
5301-5-7 Ravenswood Ave. CHICAGO

Buy a Multiplex Stripper—it's fast

The Multiplex Stripper is a rapid operating machine of large capacity, making two 8x8x16 Hollow blocks at one operation. It uses wet-mixed concrete that is stripped out of the mold box. Forty tons pressure secured by one man on the end of the lever. Pressure is applied from top and bottom. Blocks are dense, strong and, when cured, absolutely waterproof.

What it will Make

Two 8x8x16 Hollow Blocks—½, ¼ and ¾ and return corner blocks in plain and any face design.

4x8x16 Double Wall Block—½, ¼ and ¾ and return corner blocks are made two at an operation.

Also chimney blocks.

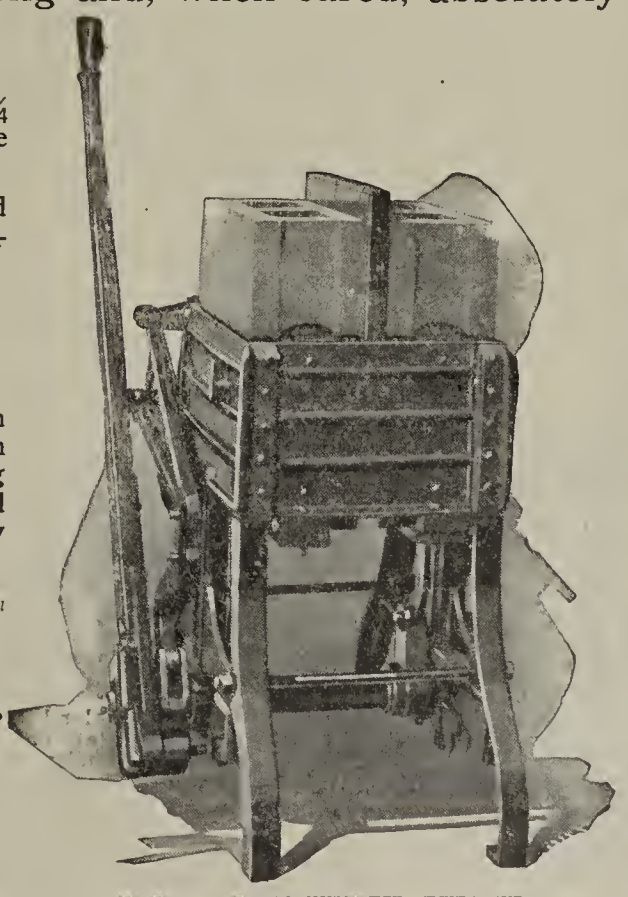
Chimney Blocks

Note the flue blocks shown at the left with the round flue in center, ventilating chambers in corners and tongue-and-groove joints insuring perfect alignment in laying up a strong, rigid chimney. There's good money in chimney blocks.

Write for our Catalogue No. 10, explaining the operation of our full line of Concrete Machinery.

Multiplex Concrete Machinery Co.
ELMORE, OHIO

Concrete Blocks—Better Buildings



FELSTONE

FOR

FACINGS

We are producing for the manufacturers of Synthetic Stone, Concrete Block or Brick, a material containing all the constituents of natural granite.

These are scientifically graded so as to furnish the densest possible aggregates of varying textures.

White Felstone Crystals for Stuccodash cannot be Surpassed.

The Southern Spar & Mica Company

HAYWOOD BUILDING
ASHEVILLE, NORTH CAROLINA

WHITESTONE

——FOR——

CONCRETE PRODUCTS
STUCCO DASH TERRAZZO
MARBLE DUST

We manufacture from WHITESTONE MARBLE and grade to proper sizes; Dust, Sand, Granito and Stucco Dash.

Shipments in carlots or less than carlots in straight or mixed sizes.

Bagged or in bulk.

Samples and prices on application.

Colors: White only.

NORTH GEORGIA MARBLE PRODUCTS CO.
WHITESTONE - - - GEORGIA

Every Engineer and Contractor

Should know Greenstone Dust. A material available in large quantities at a low cost. It increases the Tensile Strength of Concrete at least three times. Is a natural waterproofing. REPLACES economically the dull gray look of Concrete, and makes it a beautiful soft Olive Green.

Greenstone Dust for sidewalks, floors, concrete walks, foundations, Pillars, flower boxes, burial vaults, wherever cement is used.

SEND FOR SAMPLE, STATING PURPOSE

TRITSCHLER & SONS, INC.
220 W. 42nd St., New York City
Sales Representatives:
GREENSTONE PRODUCTS COMPANY, Incorporated

SELECTED WHITE SAND

UNEXCELLED FOR

Facing Concrete Blocks, Ornamental Concrete Stone, Hard Plaster, Finishing, Exterior Plastering, Roofing, Stone and Marble Sawing, etc.

Prices, Freight Rates and Samples on Application
Shipped in Paper Lined Box Cars
Small Shipments in 175-lb. Bags

Ottawa Silica Company

OTTAWA, ILLINOIS

REICHERT Adjustable Steel Molds

Improved locking device, saves time. Tight, accurate fit at joints produce smooth finish.

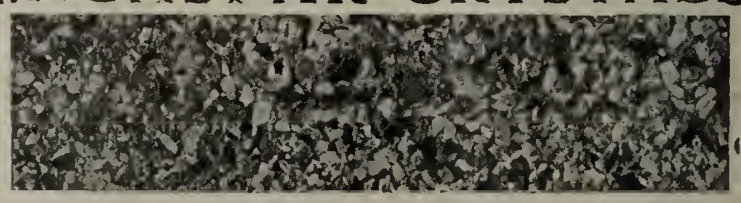
They help you land contracts
You can bid lower, at no loss of profit. Reichert Forms are standardized—units interchangeable. Ask for catalog.

Reichert Metal Concrete Forms Company
1188 Weil Street Milwaukee, Wis.

CONCRETE

BRIDGES, BRICKS, BLOCKS, BUILDING TRIM, POSTS, ORNAMENTAL WORK, CAST STONE, ETC.
WHEN TREATED WITH

MICASPAR CRYSTALS



IS CHANGED INTO

A SPARKLING GRANITE FACE

BEAUTIFUL, ARTISTIC AND EVERLASTING

Adds to your product a selling value five times greater than the facing cost.

Made in six scientifically milled sizes, extremely hard, sharp and free from dust and impurities. Insures strength and beauty. Booklet, "Micaspar and How to Use It," with free samples, mailed on request.

Crown Point Spar Co., Inc., 101 Park Ave., N. Y.

UNIVERSITY OF ILLINOIS-URBANA
3 0112 051950290